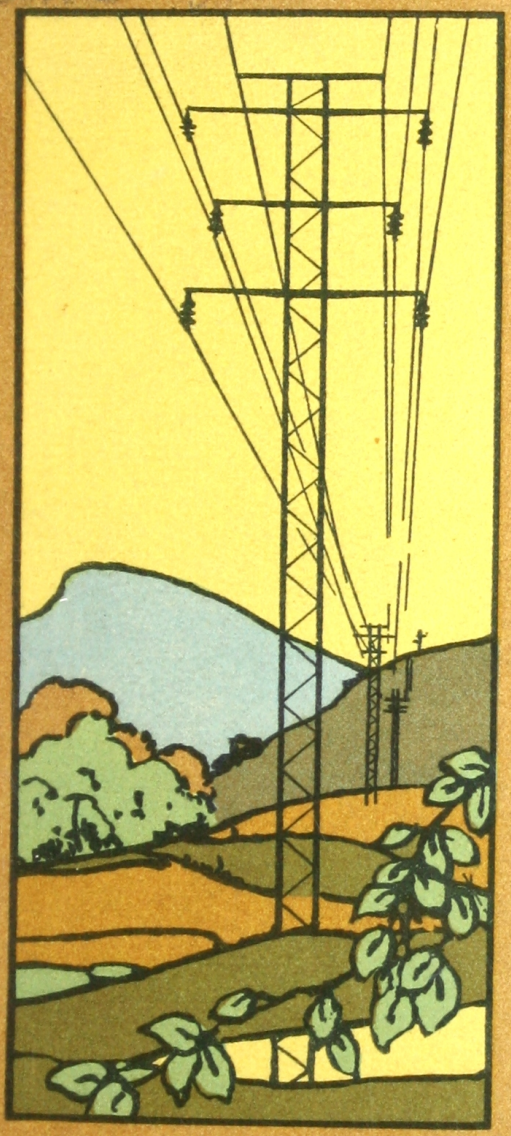
STEEL TRANSMISSION STRUCTURES AND CATENARY BRIDGES

Electric Lines - Transmission



ARCHBOLD-BRADY CO.
SYRACUSE, NEW YORK

STEEL TRANSMISSION STRUCTURES AND CATENARY BRIDGES

ARCHBOLD-BRADY CO.
ENGINEERS AND CONTRACTORS
SYRACUSE, NEW YORK

INTRODUCTION

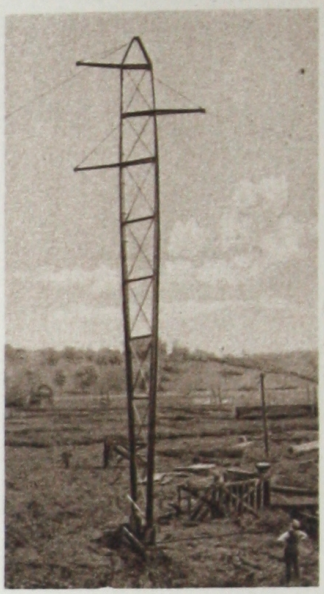
ELECTED for this book are presented views of Structures covering a wide range of designs and localities. With the idea of showing actual and varied practice, brief descriptions are given of Transmission Lines using "A" Frame Towers and Narrow Base Poles, Catenary Bridges and also Anchor Towers and Structures required for special purposes.

THE "A" FRAME TOWERS have worked out successfully under a wide variety of conditions and for voltages up to 125,000. They have been built for both pin and suspension type insulators and for conductors of all sizes and materials.

THE LACED CHANNEL POLES are particularly adapted for lines in rough country. They are of simple design, of rugged build and are easily loaded and hauled. They can be shipped riveted in one piece above the ground. The crossarms are shipped separately and are designed to suit the special requirements of the voltage and insulators to be used. Taking up little room at the ground line, the Poles save expensive right-of-way where land is valuable and on steep side hills the cost of the "benching in" or extension legs necessary for wide base towers is avoided. They can be set interchangeably with concrete bases or with our all steel foundation as may be most suited to the nature of the ground.

BOTH THE "A" FRAMES AND LACED CHANNEL POLES are stiff enough so that there is no difficulty in stringing the wires yet are so designed that in case of broken conductors they will bend and twist, relieving the strain without permanent distortion. On page 4 is shown an "A" Frame, tested by twisting nearly 90°, which after the strain was released went back to its original position without damage to the members. We believe a Transmission Line built with these Structures—anchored at suitable points by guys or

Anchor Towers—is safer from an operating standpoint than one built throughout with stiff towers which not being elastic cannot relieve themselves under the strain of broken wires and fail, or which, if the foundations yield slightly, collapse.

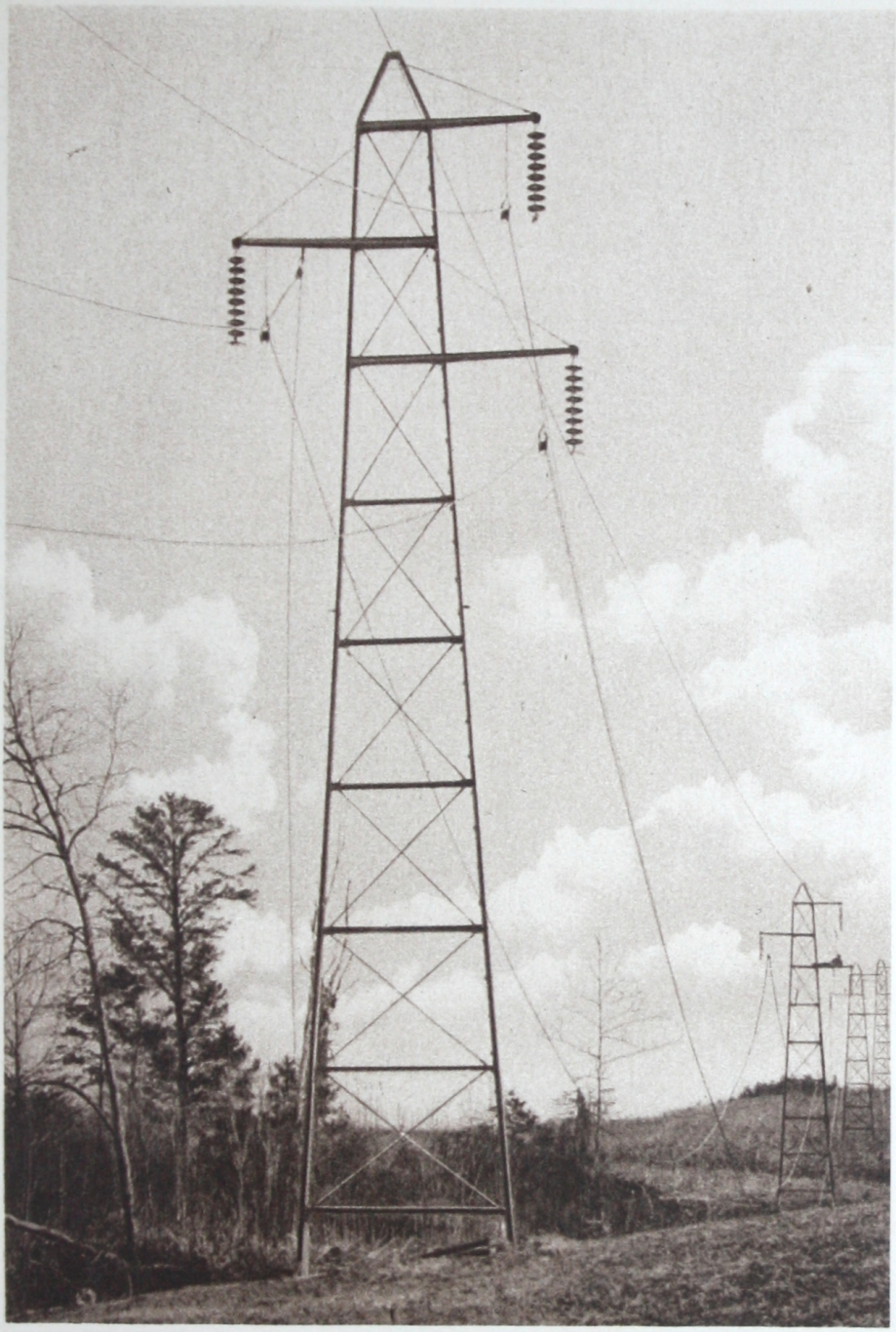


Our Structures are made of angles and plates of a minimum of $\frac{1}{4}$ in. in thickness; rods of $\frac{5}{8}$ in. minimum diameter provided with right and left hand clevises; standard channels and beams; $\frac{3}{4}$ in. rivets and bolts. The material is shipped riveted as far as possible and painted, excepting some foundation members which are galvanized. Riveting and galvanizing do not go together and we believe good practice requires the use of the minimum thicknesses of metal stated above with low ratios of length to the radius of gyration of the members, and that the material should be assembled and riveted as far as is consistent with economical loading and carefully painted with high grade paint.

In the latter pages of the book we illustrate the operations of hauling and raising our Structures. There is a demonstrated saving in field costs in handling our Assembled and Riveted Structures of few parts as against knocked down structures of many parts which have to be assembled on the ground.

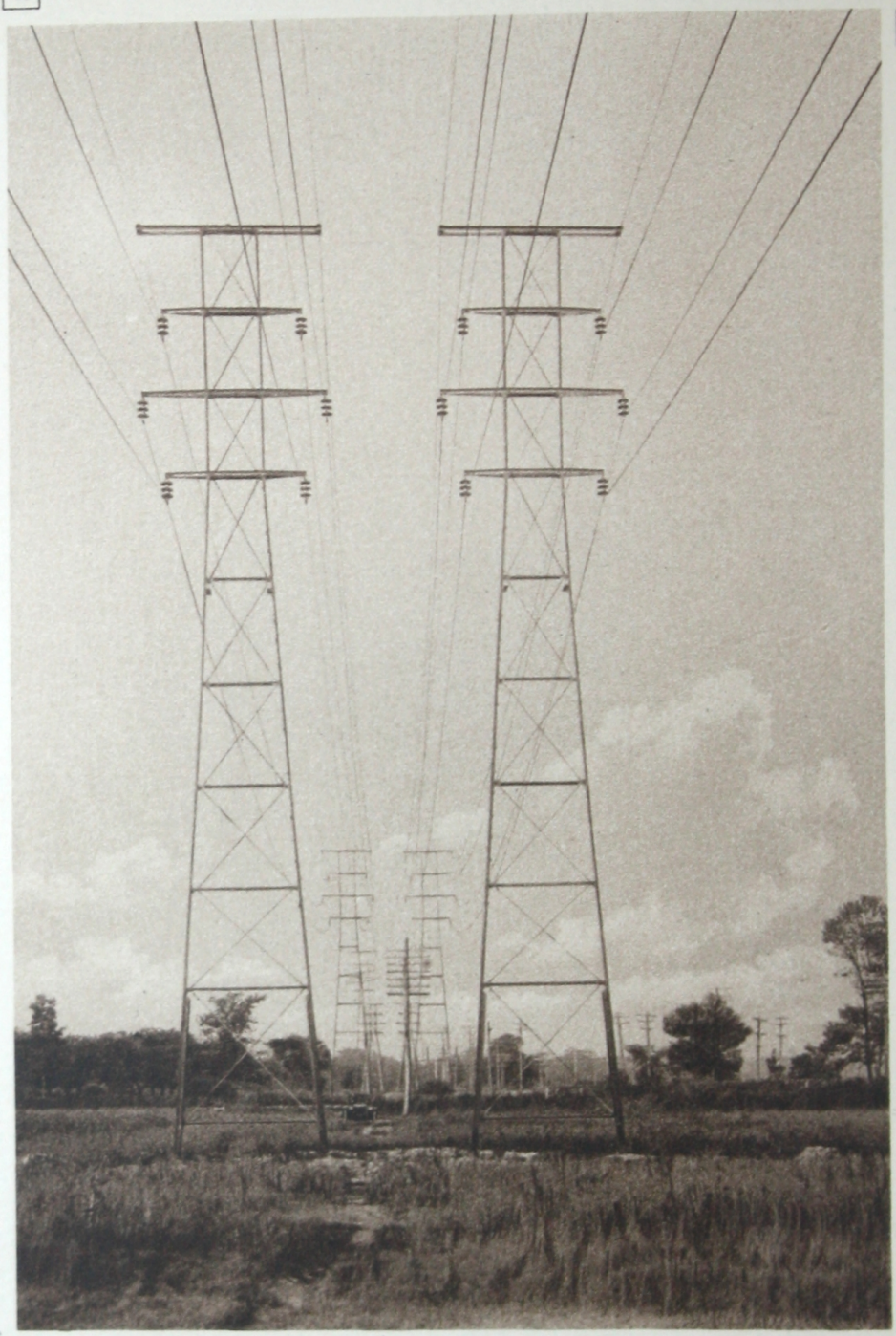
Better service to customers is now made possible since our activities are devoted exclusively to the design and fabrication of Steel Wire Supporting Structures; our field construction and other structural steel work having been discontinued.

We take pleasure in offering this book done in the Rotogravure Process which was recently introduced in this country. We believe the points of our construction are brought out in the best way by this process and hope you will find the effect artistic and pleasing.



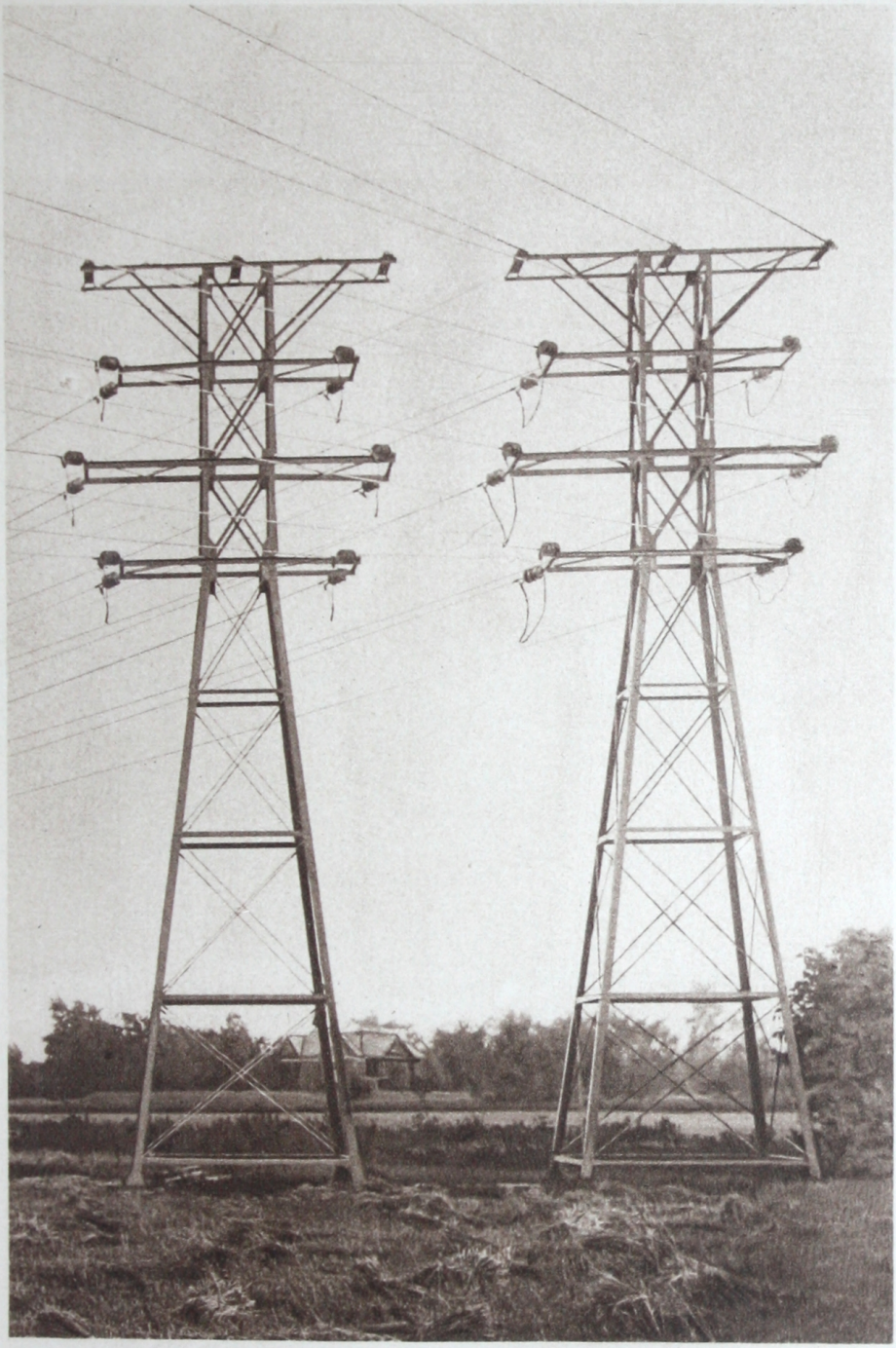
"A" FRAME LINE FOR TENNESSEE POWER COMPANY

Single circuit 125,000 volt line, 70 miles long from Parksville to the new plant of the ALUMINUM COMPANY OF AMERICA, at Maryville, Tenn. The ground wire is ⅜ in. high strength steel cable; the conductors are 400,000 C. M. aluminum stranded cables. The "A" Frames are 55 ft. high from ground line to top, are set a standard distance of 400 ft. apart with spans up to 570 ft. where they are set on elevations. The flexible Towers are guyed at intervals, square Towers being used only at heavy angles, dead-ends and river crossings. The illustration is particularly interesting as showing the way in which the cable stringing was handled. E. W. Clark & Co. Management Corporation of Columbus, Ohio, M. S. Hopkins, Vice-President, Louis R. Lee, Chief Engineer, acted as Engineers for the line.



FLEXIBLE TOWERS ON LINE OF NIAGARA FALLS POWER COMPANY

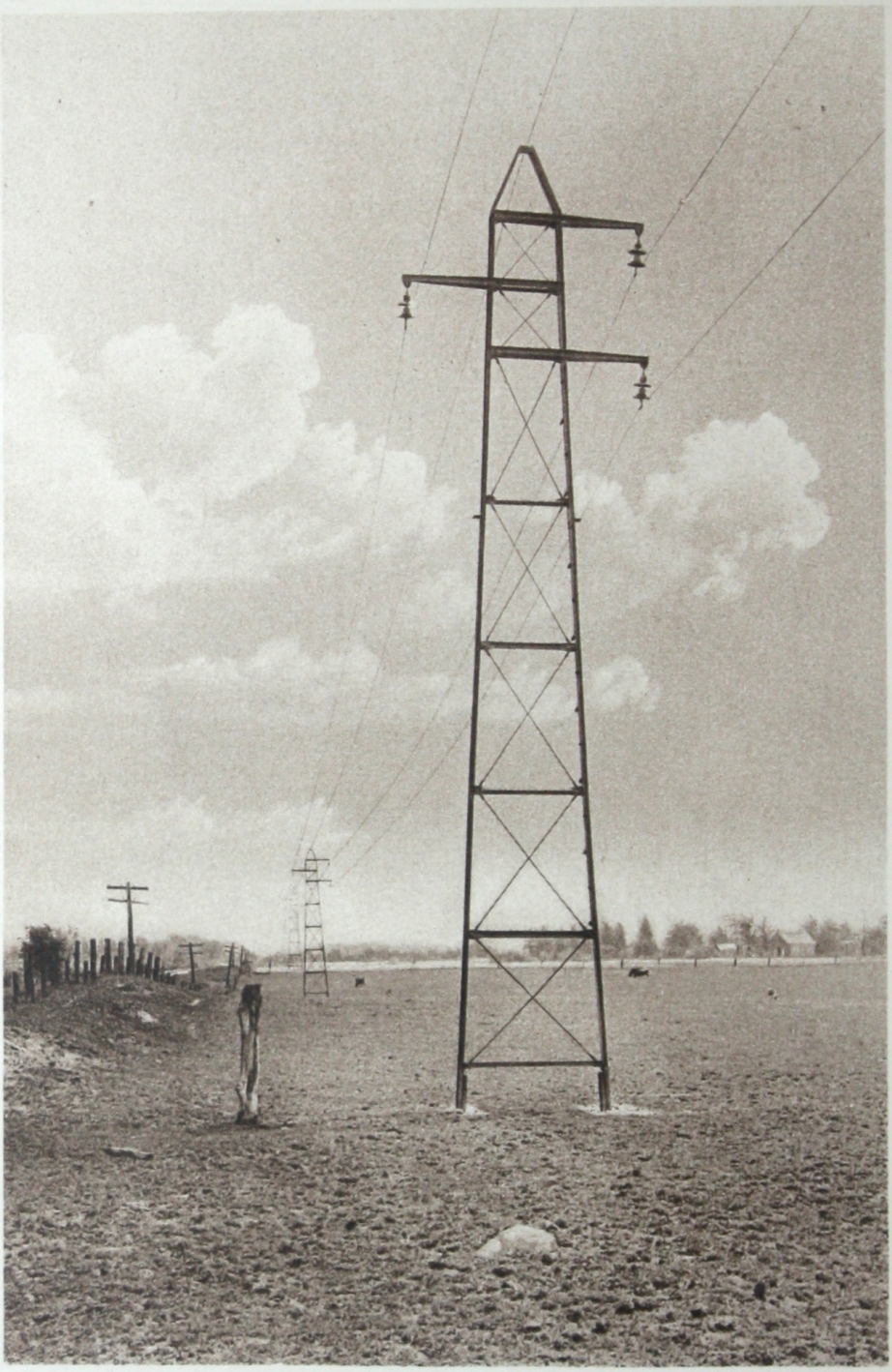
The "A" Frames shown are on a relocation around the chemical district at Niagara Falls, of the NIAGARA FALLS POWER COMPANY'S main lines to Buffalo. On account of heavy lightning conditions, three $\frac{3}{8}$-in. plow steel ground cables are installed on each line, and the four 3-phase circuits carried on the two lines of Towers are of 500,000 C. M. stranded aluminum. The spans are 350 ft. The line voltage is 22,000 volts. The Towers are designed with clearances for 45,000 volts. The "A" Frames in the foreground had extensions to make their height 63 ft. above the ground. The standard Towers are 54 ft. high, and in certain locations "A" Frames 66 ft. high were used.



RIGHT ANGLE STRUCTURES ON NIAGARA FALLS POWER COMPANY LINE

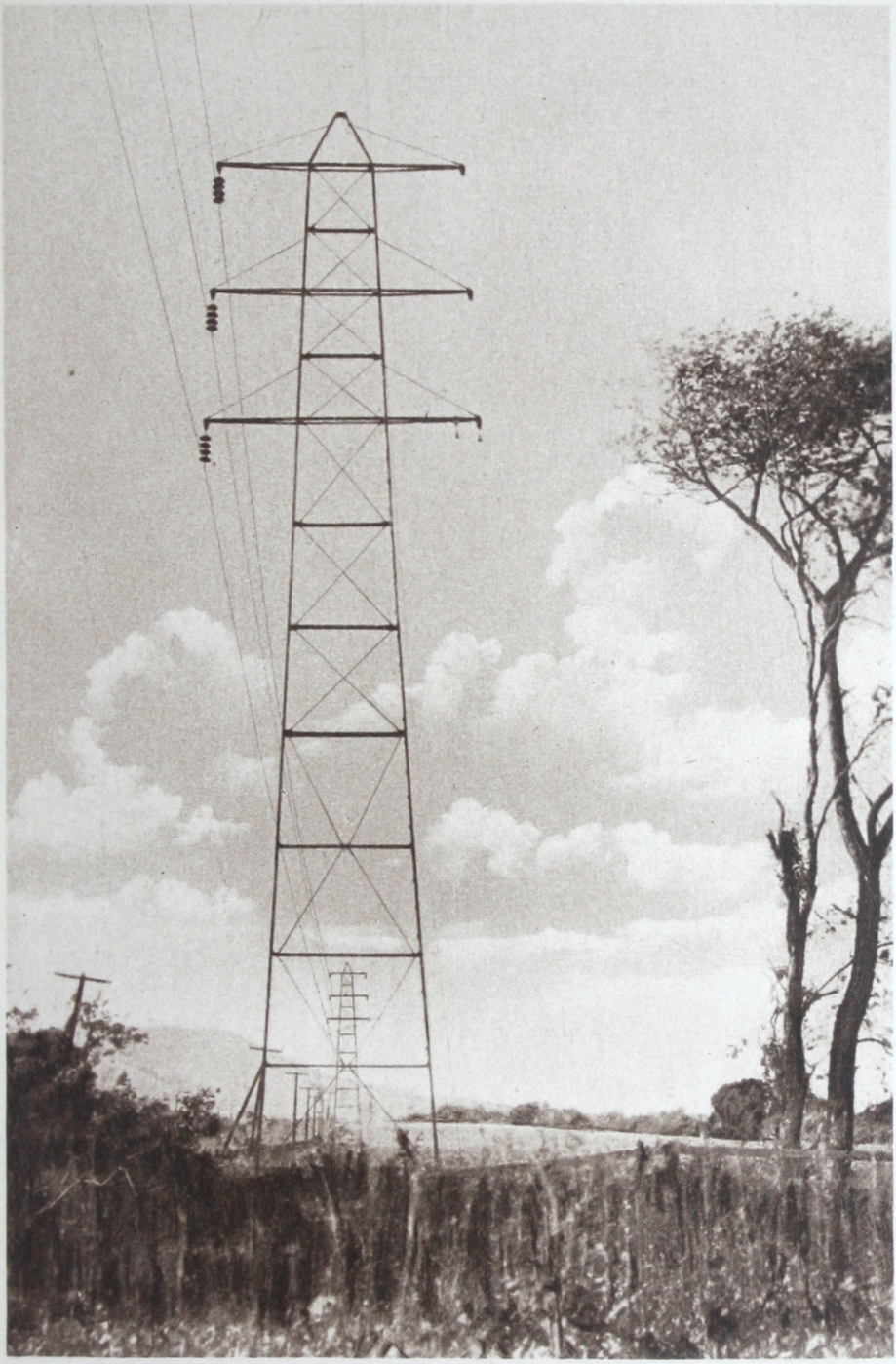
This view shows two Right Angle Structures on the NIAGARA FALLS POWER COMPANY'S line described on the opposite page. The Towers are set so that their transverse axis bisects the angle in the line.

The most effective use of the material in the Tower and foundation is attained by setting the Tower in this position, the strain of the angle being divided equally among the foundation piers and the legs of the Tower. These towers are 52 ft. in height above the ground and afford a typical example of angle construction on heavy lines.



"A" FRAME LINE IN INDIANA

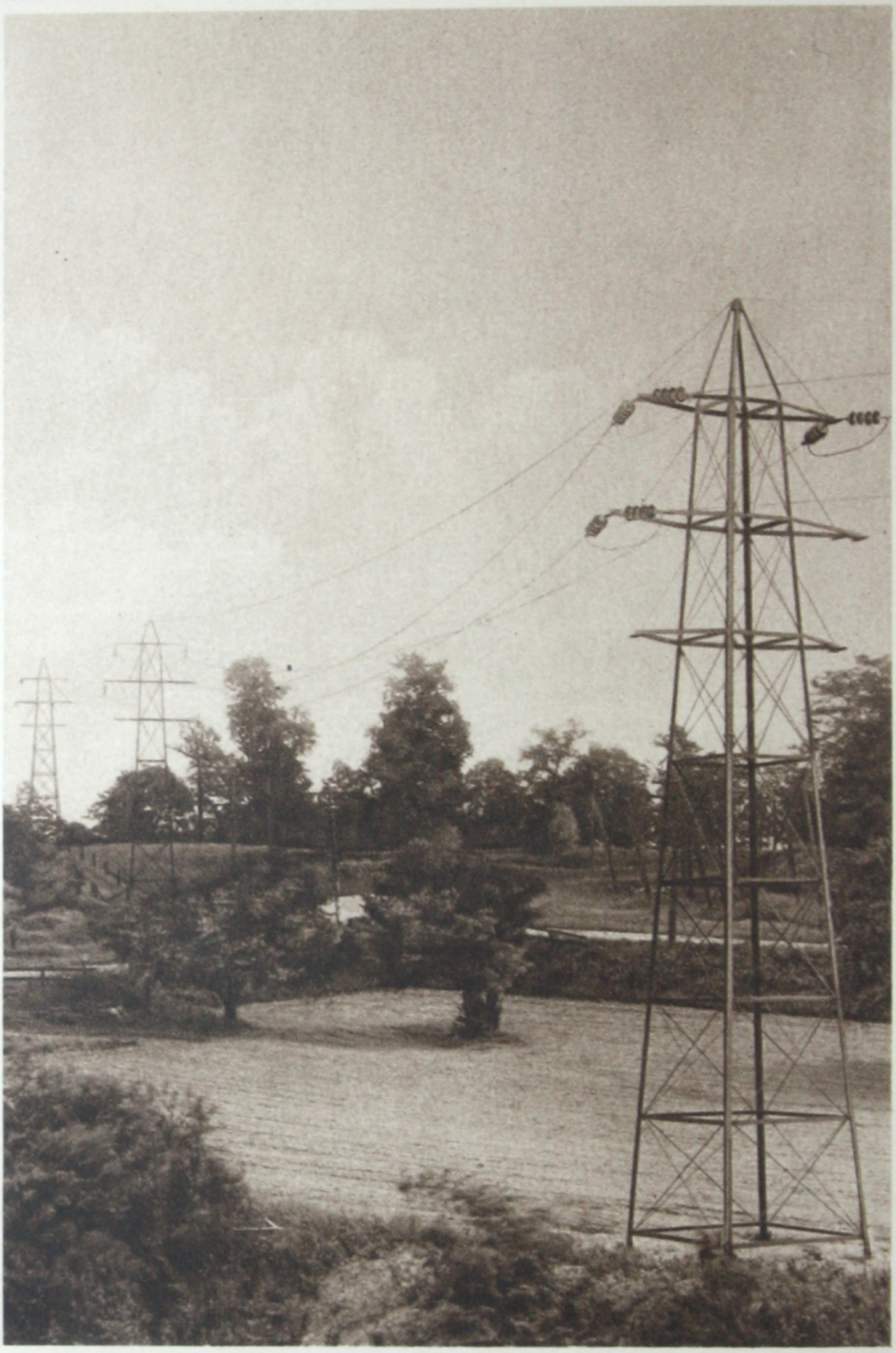
Transmission line of the MUNCIE ELECTRIC LIGHT COMPANY, from Muncie to Alexandria, a distance of 18 miles. The ground wire is ¼ in. 3-strand high strength steel. The transmission cables are No. 1 B. & S. G. 3-strand cables. The standard span is 380 ft., maximum 420 ft. The line is operated at 35,000 volts, but the Towers are designed for 60,000 volts. The property is controlled by the American Gas & Electric Company of New York, who have purchased a number of these lines both single and double circuit.



FLEXIBLE TOWERS IN CALIFORNIA

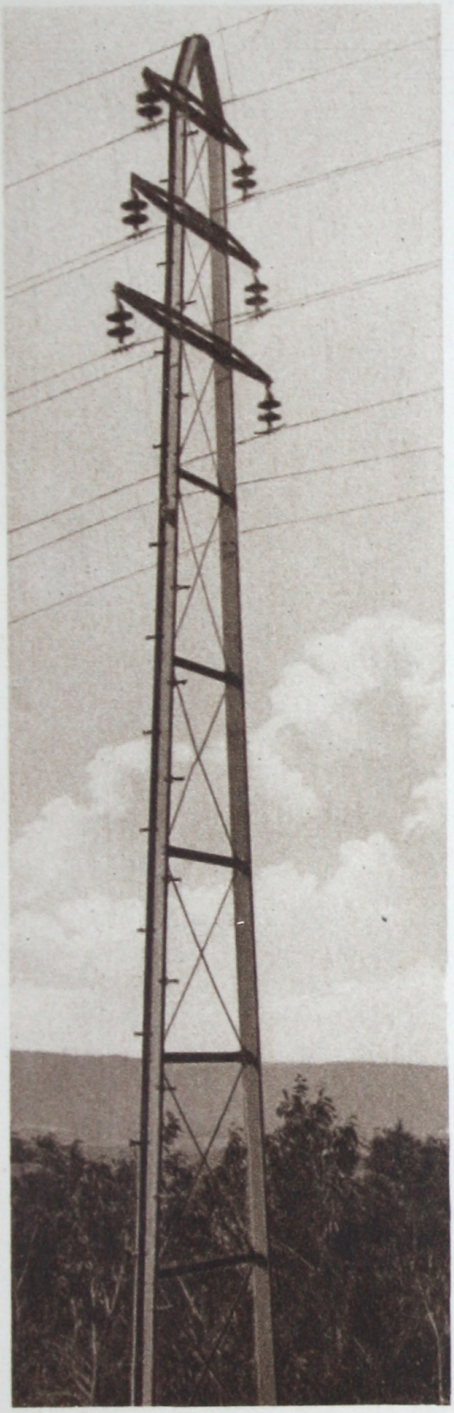
The view is on an 18-mile line of the SIERRA AND SAN FRANCISCO POWER COMPANY from Gilroy to Lagunitas. The Structures are 73 ft. high above ground with our all-steel foundations and are designed for two 110,000 volt circuits. The ground wire is a $\frac{3}{8}$ in. steel cable and the cables for the one three-phase 60,000 volt circuit carried at present are No. 00 steel core aluminum. The standard spans are 800 ft., the maximum 900 ft.

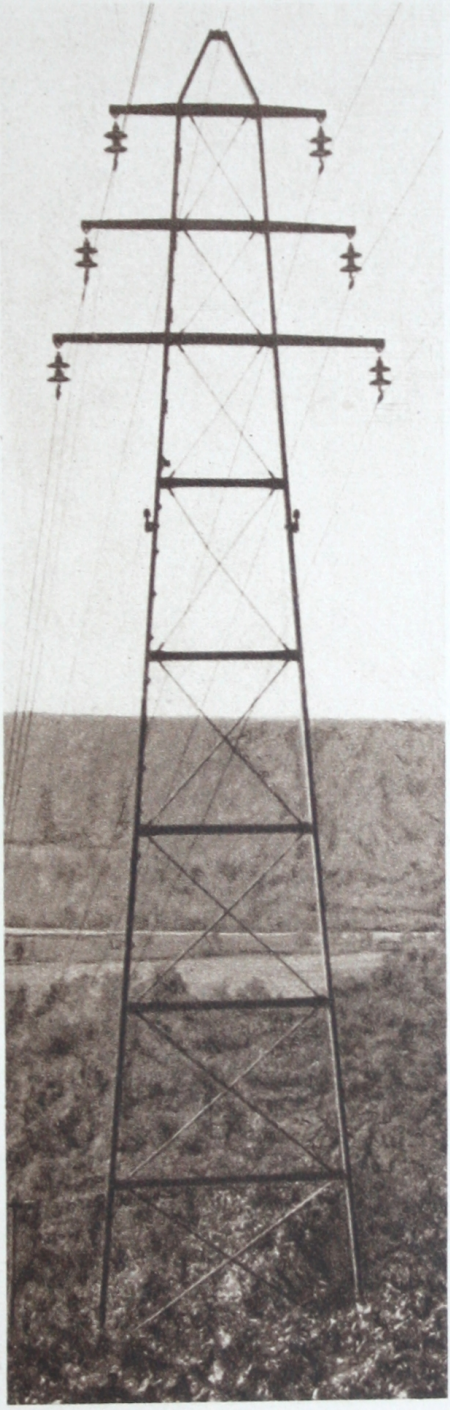
Ford, Bacon & Davis of New York acted as Engineers for the line.



TRANSMISSION LINE IN OHIO

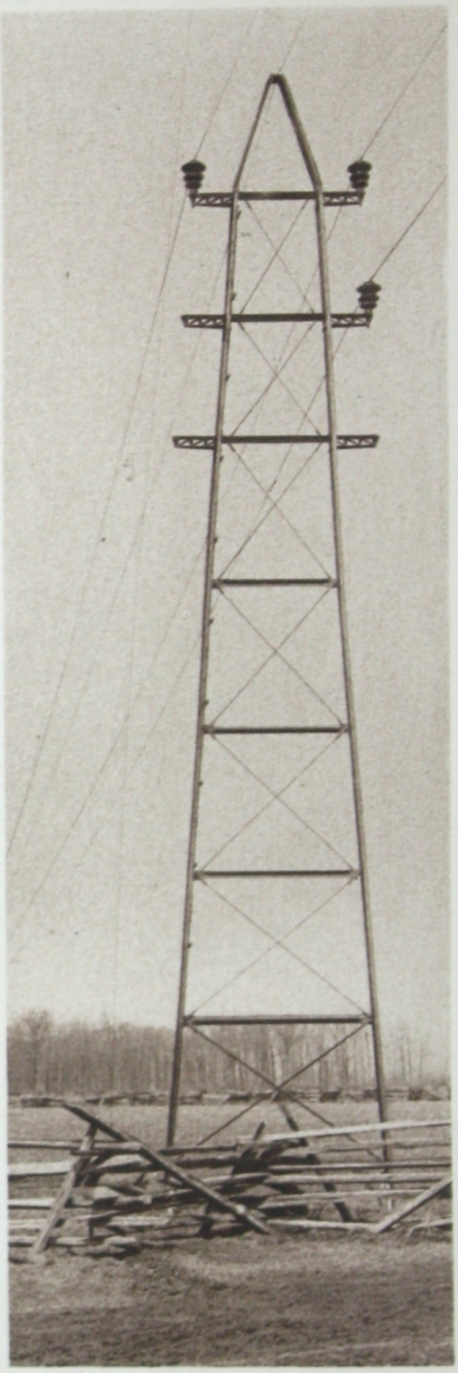
Square Tower with "A" Frames in the distance on a 16-mile line of the DAYTON POWER & LIGHT COMPANY from Dayton to Xenia. The line is designed for double circuit 60,000 volts, No. 2/0 B. & S. stranded copper; at present operated with one circuit 14,000 volts with No. 2 B. & S. stranded copper. The ground wire is ¼-in. stranded copper clad. The standard span is 440 ft. The maximum span with "A" Frames on elevations is 624 ft., using $\frac{7}{16}$-in. stranded copper clad for conductors.





SUSPENSION TYPE INSULATOR "A" FRAME LINE IN PENNSYLVANIA

The two views show Structures on the 10-mile 22,000 volt tie line of the LEHIGH NAVIGATION ELECTRIC COMPANY, John S. Wise, Jr., General Manager, Hazelton, Pa., between the Harwood and Hauto Power Houses. The ground wire is $\frac{3}{8}$ in. high strength steel cable, the six transmission cables are 250,000 C. M. copper, standard spans are 440 ft. and the maximum on "A" Frames is 520 ft. On account of extreme lightning conditions, suspension type insulators were adopted. The views give an idea of the mountainous country which the line traverses.



"A" FRAME LINES IN MINNESOTA AND CANADA

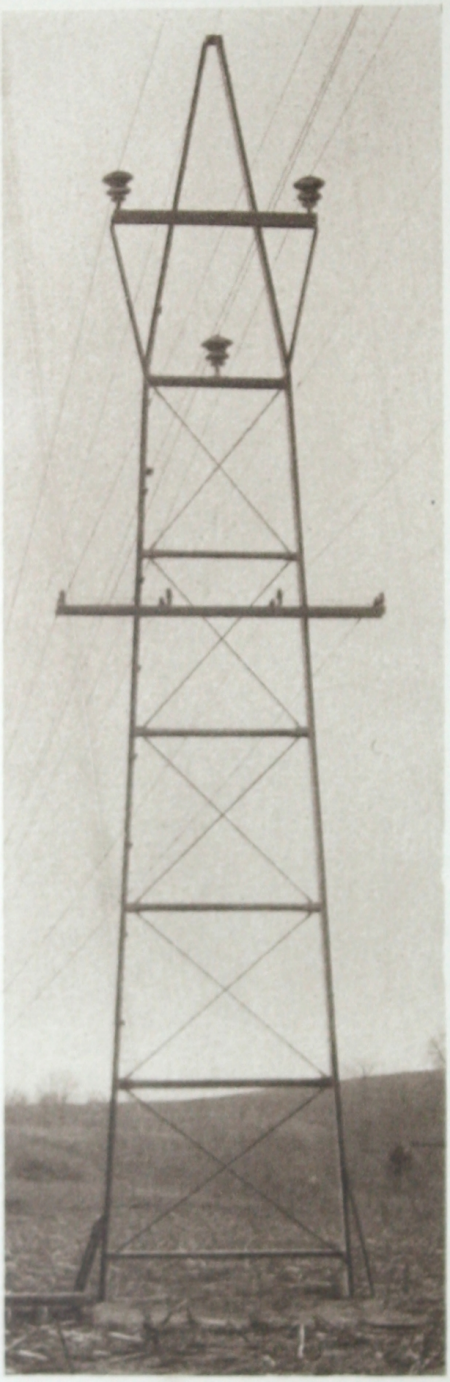
The left-hand illustration shows an "A" Frame now carrying suspension type insulators on 40-mile line of MINNEAPOLIS GENERAL ELECTRIC COMPANY, between Taylors Falls and Minneapolis, changed from a pin type line as shown in our previous catalog. It is operated at 55,000 volts, the line conductors are No. 4/0 stranded copper with a ⅜-in. steel ground wire. The "A" Frame shown is 64 ft. high from ground line to the top.

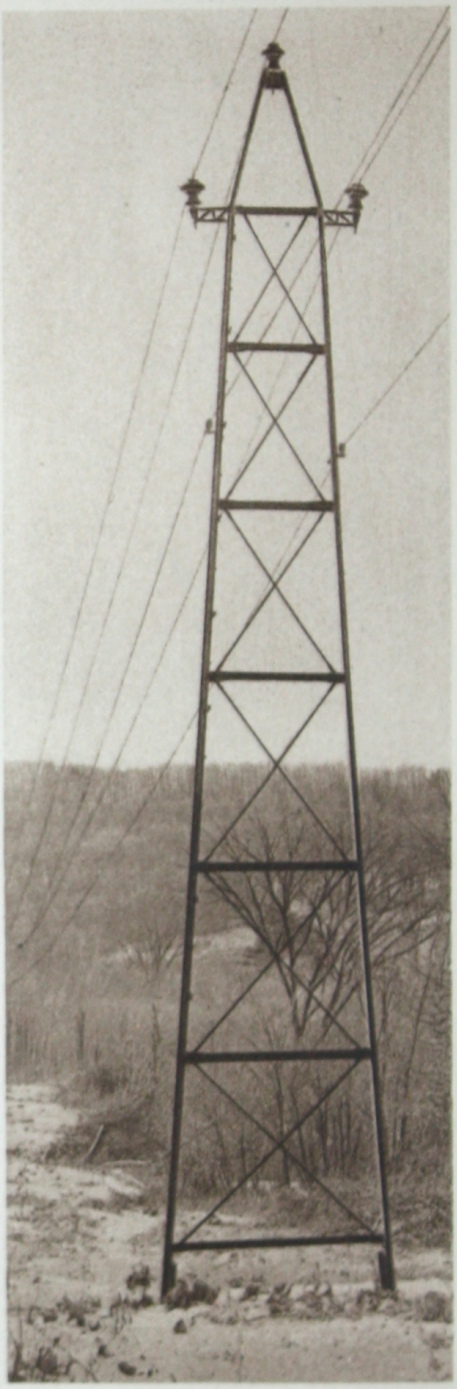
On the right is shown a view on the 32-mile 45,000 volt line of the DOMINION POWER & TRANSMISSION COMPANY, from the hydraulic plant at St. Catharines, Ontario, to Hamilton. The standard span is 400 ft. The three conductors at present installed are No. 4/0 copper strand with a copper clad ground wire.

FLEXIBLE TOWER LINE IN NEW YORK STATE

An 18,000-ft. 13,200 volt line along the FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD, between Tribes Hill Power House and Amsterdam sub-station. The ground wire is 7-strand, $\frac{3}{8}$ in. high strength steel. The transmission wires are No. 00 hard drawn solid copper. The standard span is 350 ft. The standard height of the Structures is 36 ft. from ground line to low wires. The view shows extension on side hills to obviate necessity of "benching in."

Under broken wire strains caused by heavy sleet and wind, similar "A" Frames twisted and relieved themselves without damage.





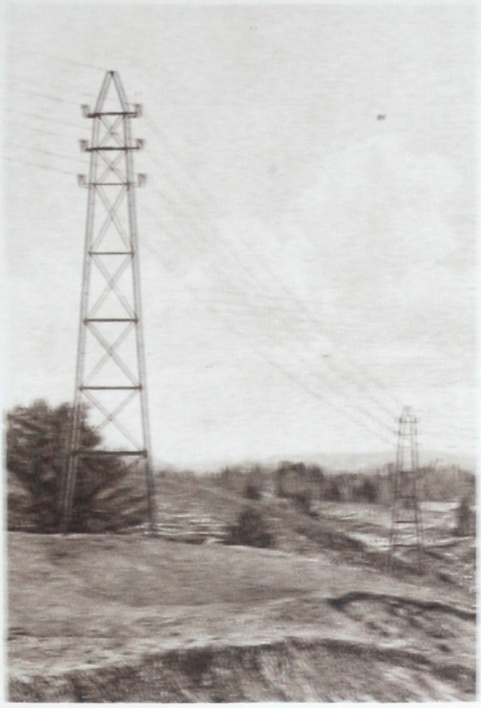
"A" FRAMES IN OZARK HILLS OF MISSOURI AND BERKSHIRE HILLS OF MASSACHUSETTS

The left-hand illustration is on a 22-mile 66,000 volt line of the OZARK POWER & WATER CO., controlled by Henry L. Doherty & Co., New York. Two ground wires are used, one above and one below the No. 2/0 copper transmission cables. The standard span is 440 ft., with maximum on "A" Frames of 660 ft. with 125 ft. difference in level between the bases of the Towers.

On the right is shown a view of the 16-mile 33,000 volt single circuit line of the BERKSHIRE STREET RAILWAY CO., Mr. P. W. Ripple, Chief Engineer, New Haven, Conn. No ground wire is used. The standard span is 400 ft., maximum on "A" Frames 550 ft., on Anchor Towers 1,700 ft.

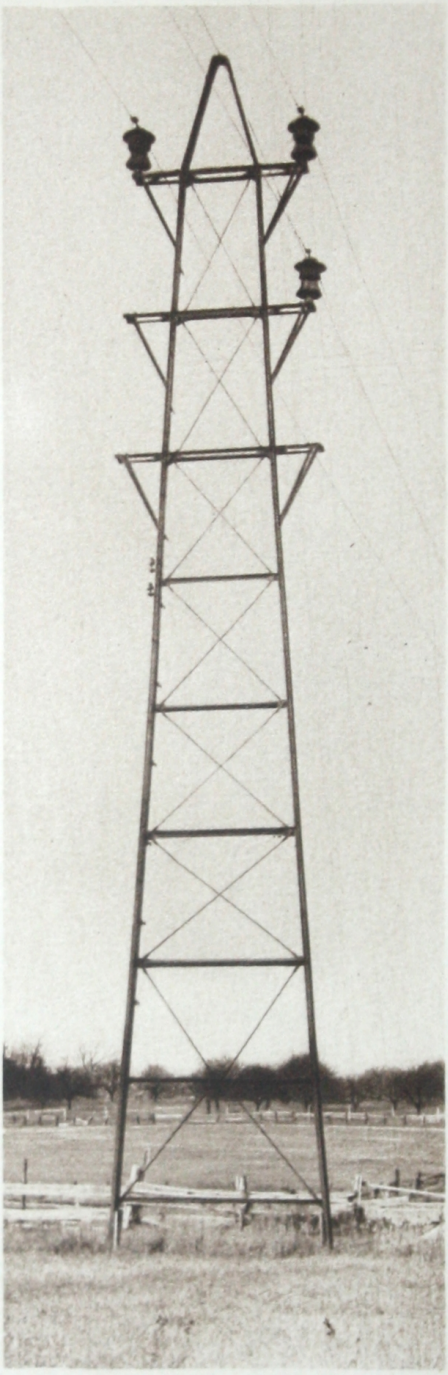
BERKSHIRE STREET RAILWAY DOUBLE CIRCUIT LINE

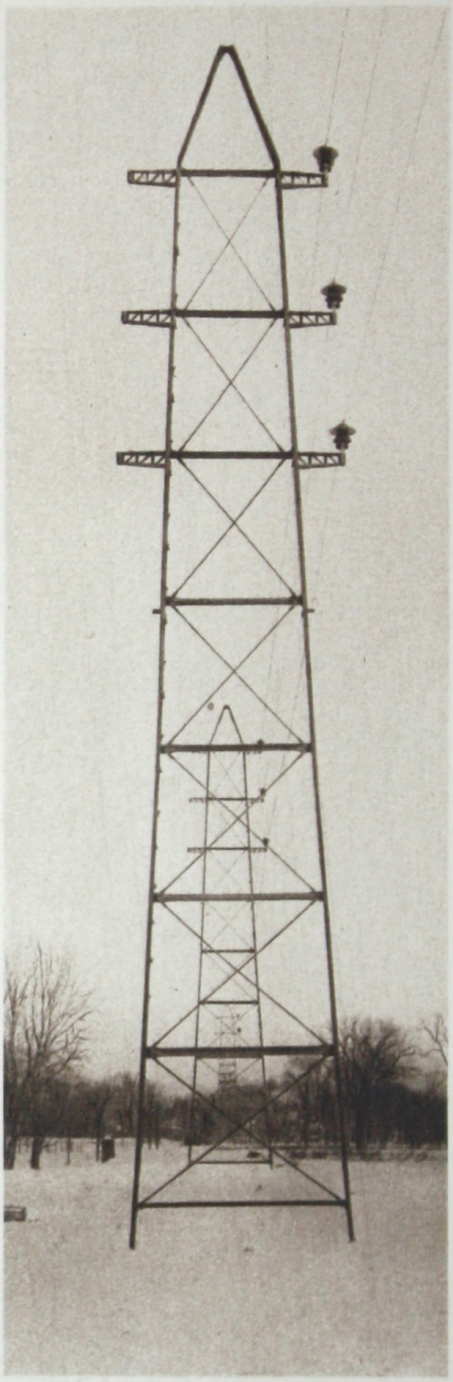
The upper illustration shows double circuit 33,000 volt Structure on 11-mile line from Pittsfield to Lee, Mass. No ground wire is used. The line cables are No. 0 stranded copper, the standard span is 400 ft. and the maximum 550 ft.



FLEXIBLE TOWERS IN STATE OF WASHINGTON

Structures shown were used for 55,000 volt lead from the White River Power House of the PUGET SOUND TRACTION, LIGHT & POWER COMPANY near Tacoma, to wooden pole lines previously built. No ground wires were used. The six transmission cables are No. 4/0 19-strand B. & S. copper. The standard span is 400 ft., the maximum 500 ft. Stone & Webster Engineering Corporation built the line.





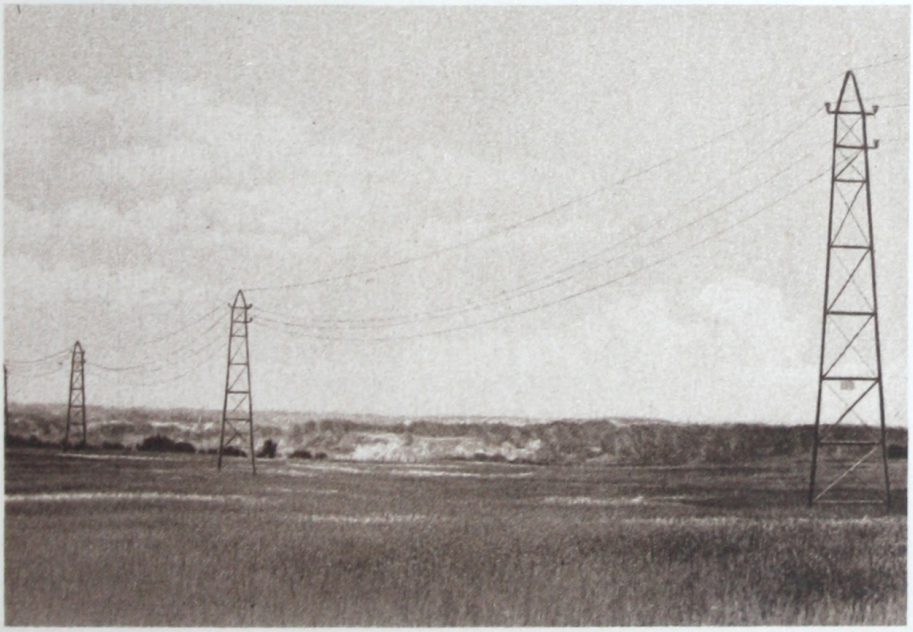
"A" FRAMES IN NEW YORK AND NEW HAMPSHIRE

The left-hand view shows a 12½-mile line of the ADIRONDACK ELECTRIC POWER CORPORATION. The Structures are designed for 60,000 volts but operated at present at 33,000. The ground wire is ⅜ in. Siemens-Martin strand, the transmission cables 7-strand No. 3/0 hard drawn copper. Standard spans are 450 ft., maximum on "A" Frames 600 ft.

Shown on the right is a view of the 20-mile line of the KEENE GAS & ELECTRIC COMPANY of New Hampshire from Hinsdale to Keene. The ground wire is ⅜ in. high strength steel strand, the transmission wires No. 1/0 hard drawn copper strand, the standard span is 440 ft. with maximum on "A" Frames of 520 ft. Stone & Webster Engineering Corporation of Boston, Mass., were Engineers for both lines.

TWO LINES IN NEW YORK STATE

The upper picture shows square Tower with "A" Frames in distance on 14-mile line of WATERTOWN LIGHT & POWER COMPANY from Carthage to Black River. The Structures are designed for 44,000 volt clearances, the line is operated at present at 22,000 volts. The ground wire is $\frac{3}{8}$ in. Siemens-Martin strand, the three transmission cables are No. 0 copper strand; the standard span is 440 ft., the maximum 700 ft.



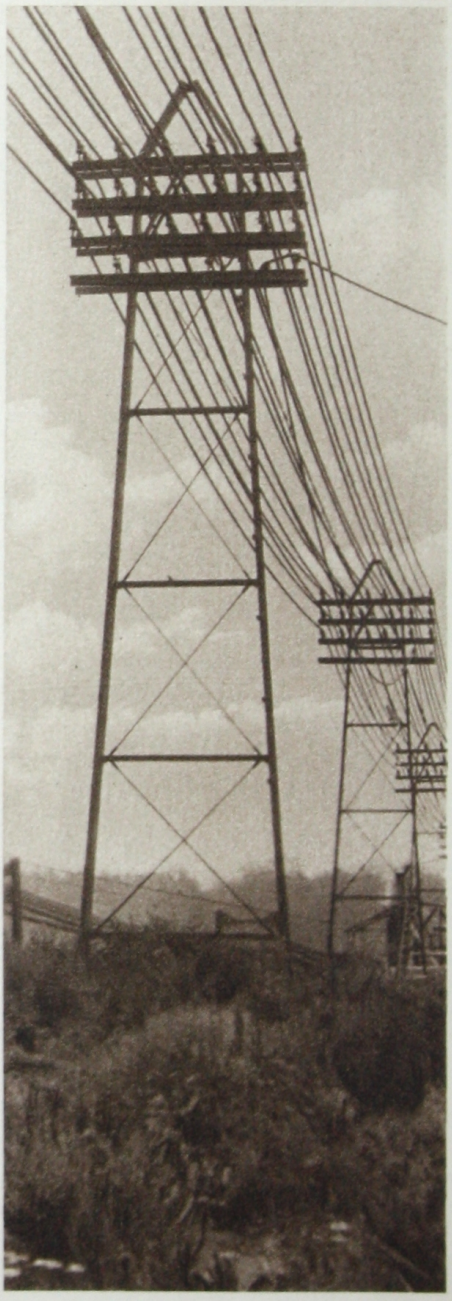
The lower picture shows "A" Frames on 15½-mile line of UTICA GAS & ELECTRIC COMPANY from Trenton Falls to Rome. The voltage is 22,000, the ground wire $\frac{5}{16}$ in. Siemens-Martin strand, the three transmission cables No. 00 7-strand copper. The standard span is 440 ft., the maximum 550 ft. The vertical channels on "A" Frames on both lines are punched for three additional crossarm brackets which can be furnished for a second circuit when required.

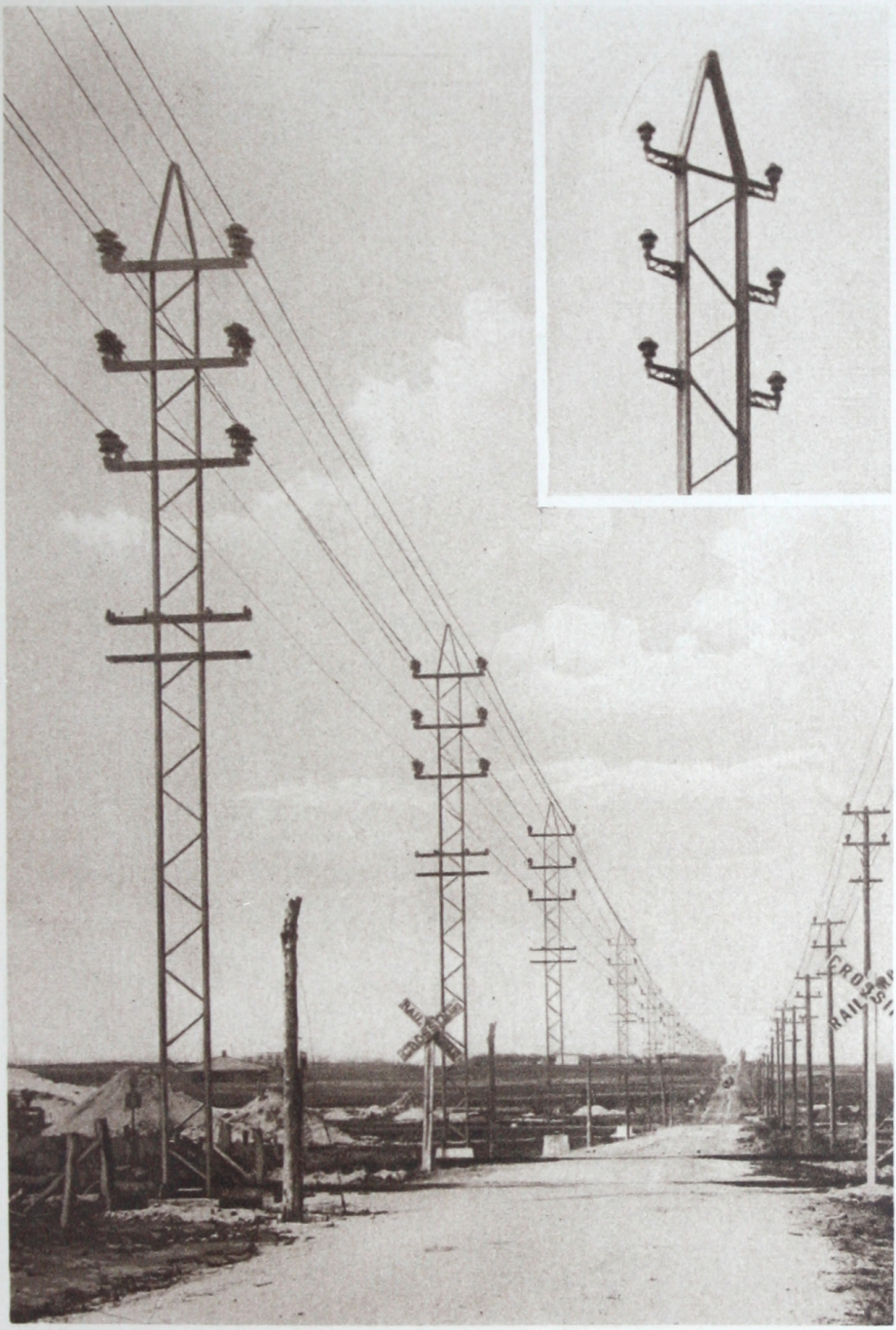
"A" FRAMES FOR HEAVY INDUSTRIAL LINES IN NEW YORK AND PENNSYLVANIA

The upper illustration shows a 4-circuit, 64-ft. Tower on the 4,200 volt distribution lines of the DELAWARE, LACKAWANNA & WESTERN RAILROAD COMPANY from the Nanticoke Power House to various Collieries. The "A" Frame is located at a crossing over a steam railroad requiring the grounding arm shown. The standard span is 440 ft., maximum 510 ft.

The 12-line conductors are No. 0 copper strand with stranded steel ground wire. Mr. H. M. Warren, Electrical Engineer, Scranton, Pa., was Engineer.

Below is shown a heavy line carrying power between various buildings of the ALUMINUM COMPANY OF AMERICA at Massena, N. Y. The ground cable is $\frac{3}{8}$-in. steel strand, the 18 cables are 1,590,000 C. M. aluminum with weather-proof insulation over 2 in. in diameter. The voltages vary from 500 to 6,600 volts on the different circuits; spans are from 75 to 100 ft.

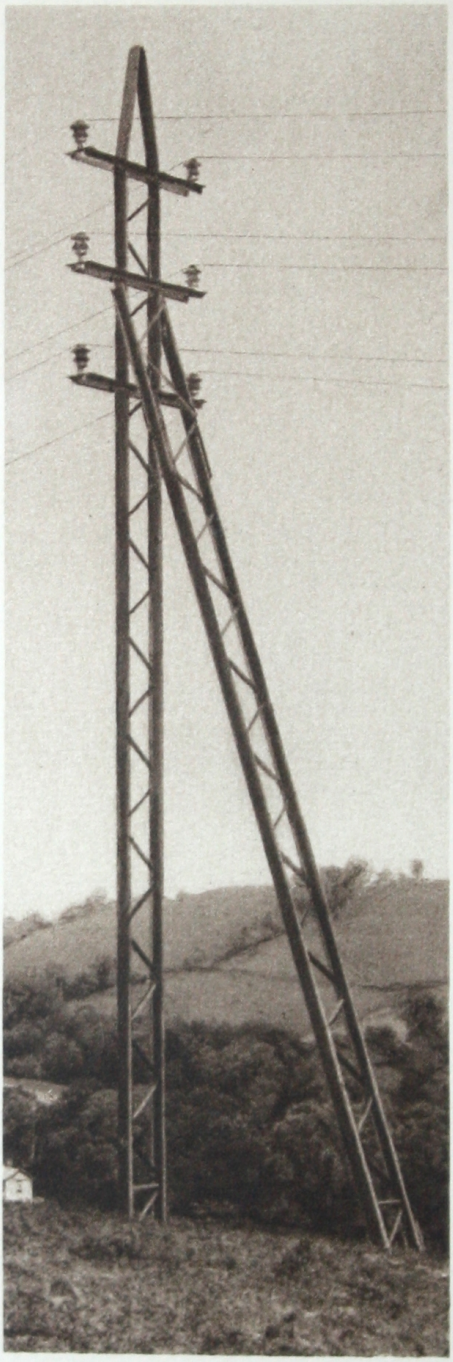


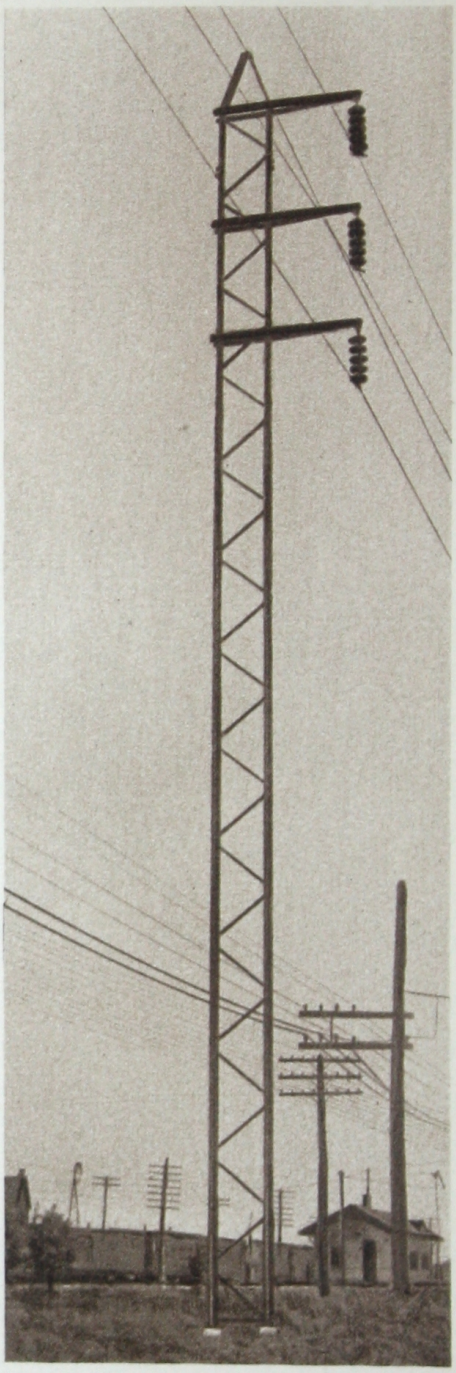


LACED CHANNEL POLES

The large illustration shows Laced Channel Pole line of the EMPIRE DISTRICT ELECTRIC COMPANY of Joplin. These Structures are used in Joplin and Springfield, Mo., over a total length of 4 miles to bring 66,000 volt circuits into sub-stations. The ground wires are $\frac{5}{16}$ in. stranded Siemens-Martin cable, transmission wires in Joplin No. 0 solid copper, in Springfield No. 2/0 stranded copper. The Joplin line carries two telephone circuits and the Springfield line four telephone circuits. The standard span is 280 ft.

The small view shows top of pole of this type with our malleable iron cross-arm brackets. Where only one circuit will be required for some time, three brackets are provided, the channels being punched for the other three brackets which can be easily installed later.

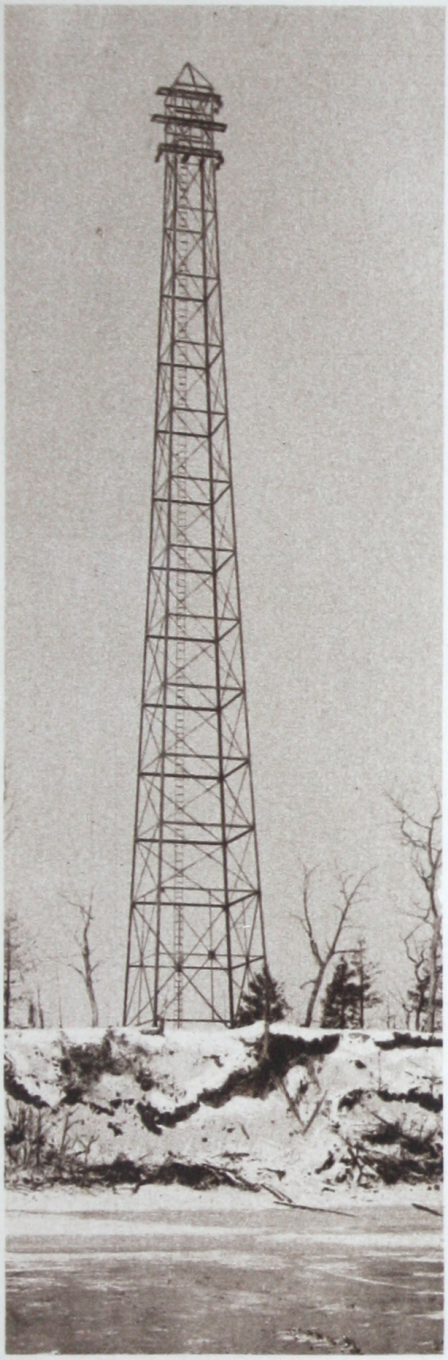


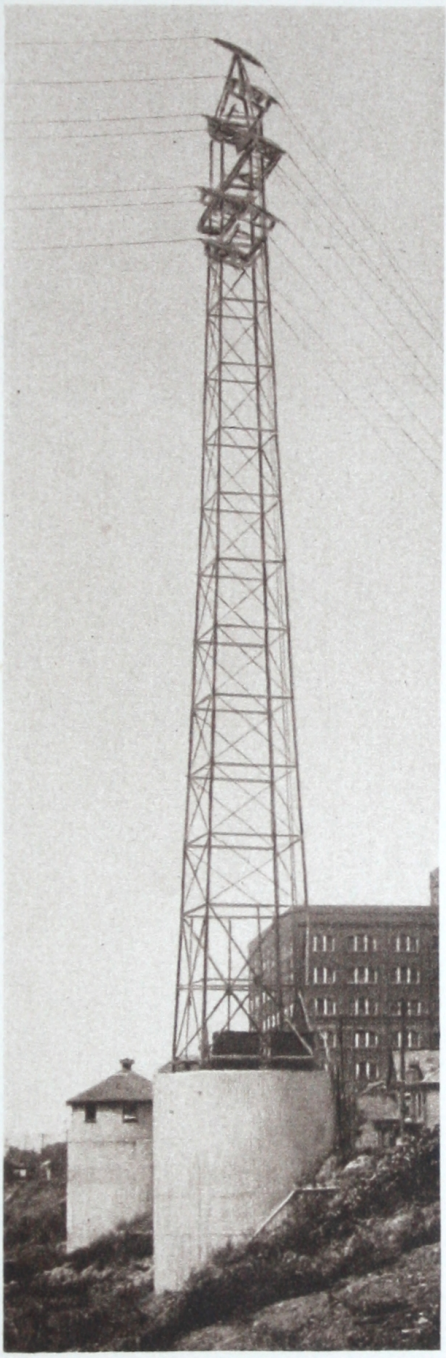


LACED CHANNEL POLES IN W. VIRGINIA AND ILLINOIS

The left-hand view shows a 44,000 volt, 54-ft. braced Laced Channel Pole or "Jack" of THE VIRGINIAN POWER COMPANY, Mr. C. O. Lenz, Chief Engineer, 71 Broadway, New York. Spans up to 830 ft. were carried on these structures. Our all-steel foundations support Poles and braces.

The right-hand view shows a 60-ft. Laced Channel Pole on the EAST ST. LOUIS & SUBURBAN RAILWAY COMPANY line from Alton to East St. Louis carrying a single 66,000 volt suspension type insulator circuit on one side on account of the right-of-way conditions. Spans are 400 ft. These Poles were particularly suited to this location on account of the narrow base required by the right-of-way. E. W. Clark & Co. Management Corporation of Columbus, Ohio, built the line.

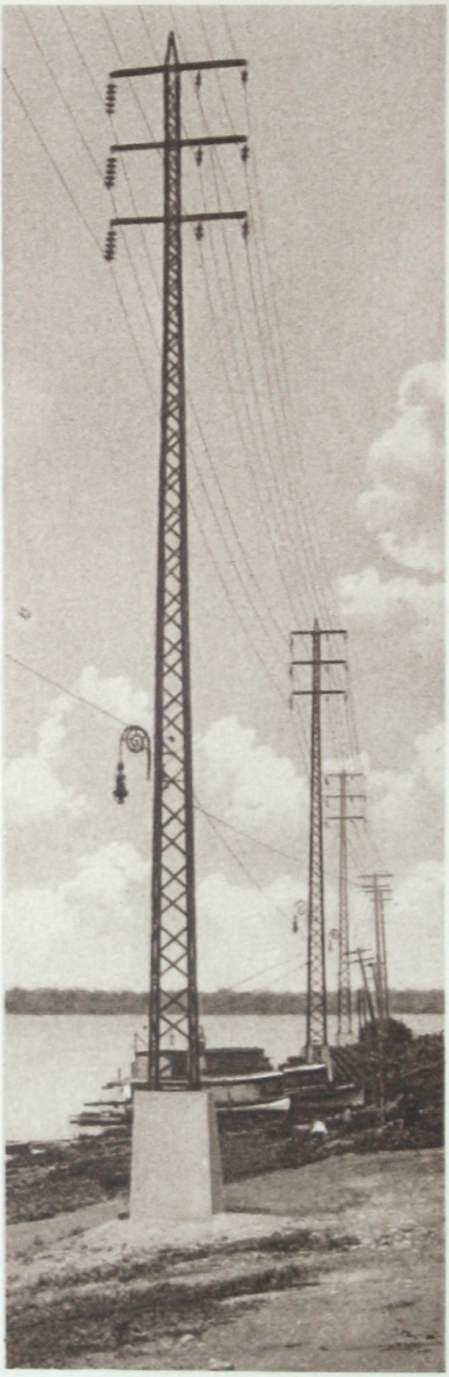


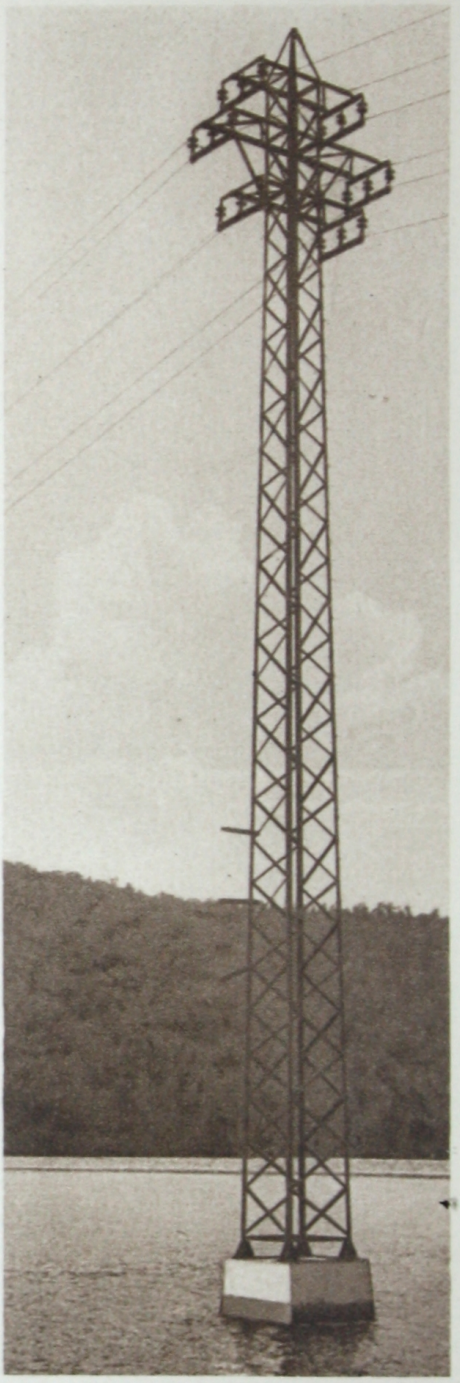


HIGH TOWERS IN MAINE AND WEST VIRGINIA

The left-hand view shows 169 ft. Tower on 800 ft., 33,000 volt crossing of CENTRAL MAINE POWER COMPANY over the main ship channel of the Kennebec River at Farmingdale, near Augusta, Me. The No. 2/0 copper strand conductors are carried back to Anchor Towers.

On the right is shown 160-ft. Tower set on well at the WHEELING ELECTRIC COMPANY plant, carrying 1,685-ft. span over the Ohio River. The 311,000 C. M. copper clad steel transmission cables and ground wire are brought over roller saddles. On account of the heavy outward strain due to the short distance to the anchor on the Power House, this Tower is guyed. The Company is controlled by the American Gas & Electric Company, of New York, and Sargent & Lundy of Chicago were Engineers for this crossing.





HIGH POLES IN ILLINOIS AND PENNSYLVANIA

On the left is shown Pole 90 ft. above foundation, which is 10 ft. above the ground, along the Levee at Alton, on the EAST ST. LOUIS & SUBURBAN RAILWAY COMPANY line to East St. Louis, another structure of which is shown on page 20. These Poles, set on spans up to 400 ft., carry one 66,000 volt circuit, two 13,200 volt circuits and a ground cable.

The right-hand view shows a 90-ft. Pole on a 1,300-ft. span over the artificial lake at Hauto Power House of the LEHIGH NAVIGATION ELECTRIC COMPANY line described on page 11. Six 250,000 C. M. copper clad cables are carried over roller saddles supported by suspension type insulators back to Anchor Towers. Shortly after completion this crossing withstood a heavy sleet and wind storm.

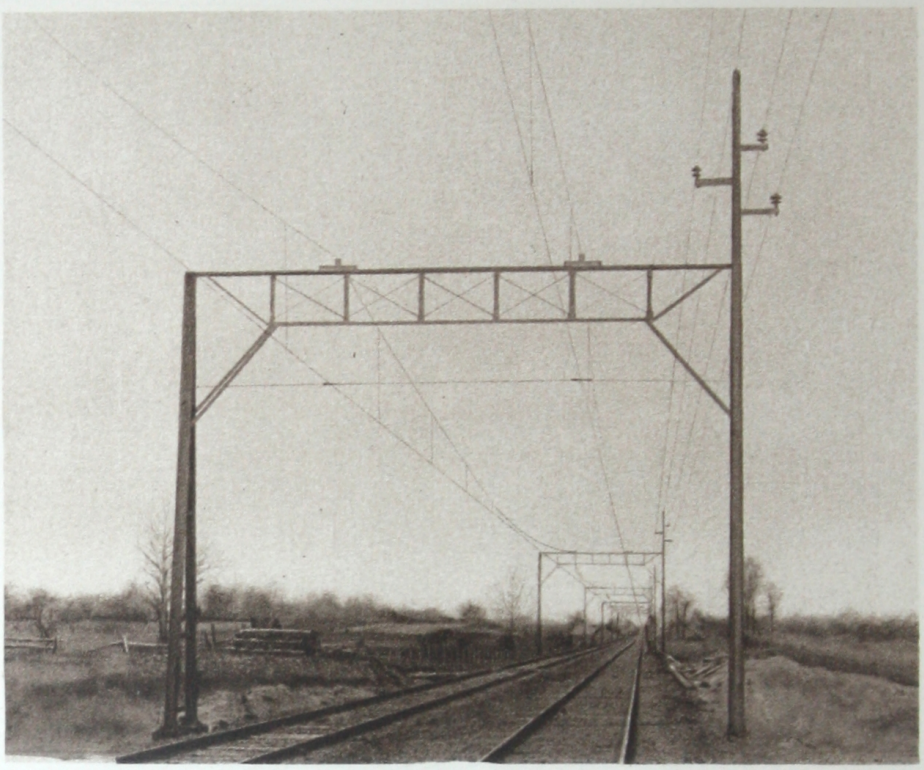
LACED ANGLE POLES IN OHIO AND NEW YORK

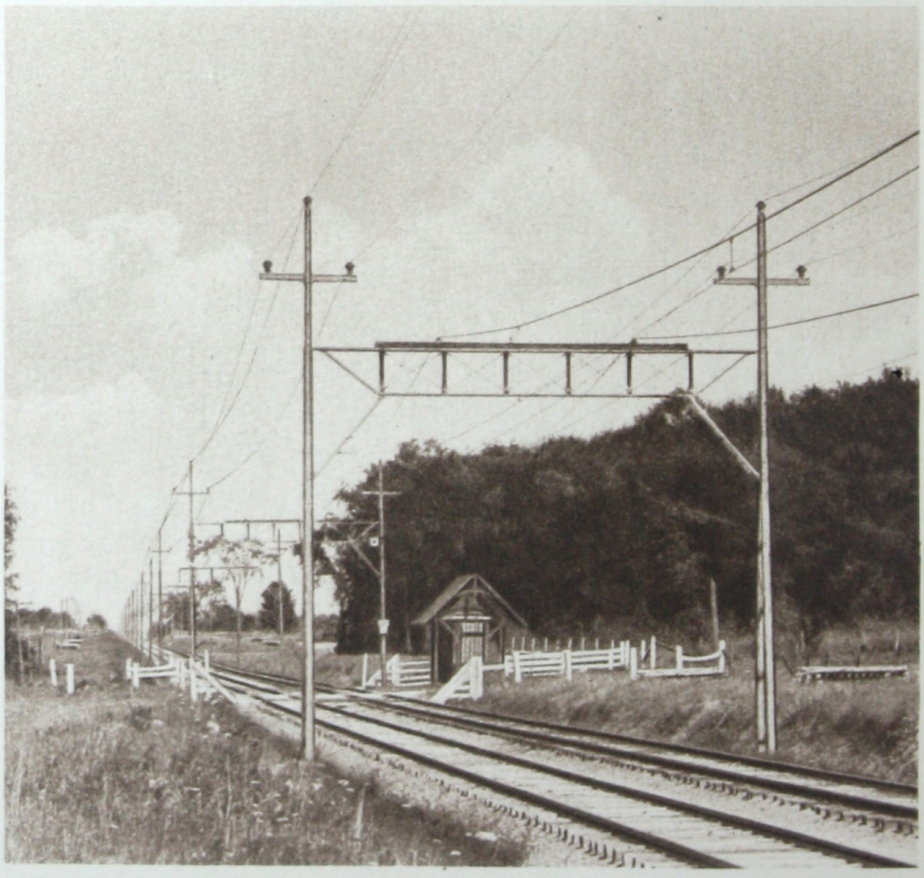
The upper left-hand view shows Pole line of the DAYTON P. & L. CO. in Xenia, Ohio, on an extension of line shown on page 10. The line is 4,000 ft. long, the maximum span 300 ft. with an angle at every Pole.

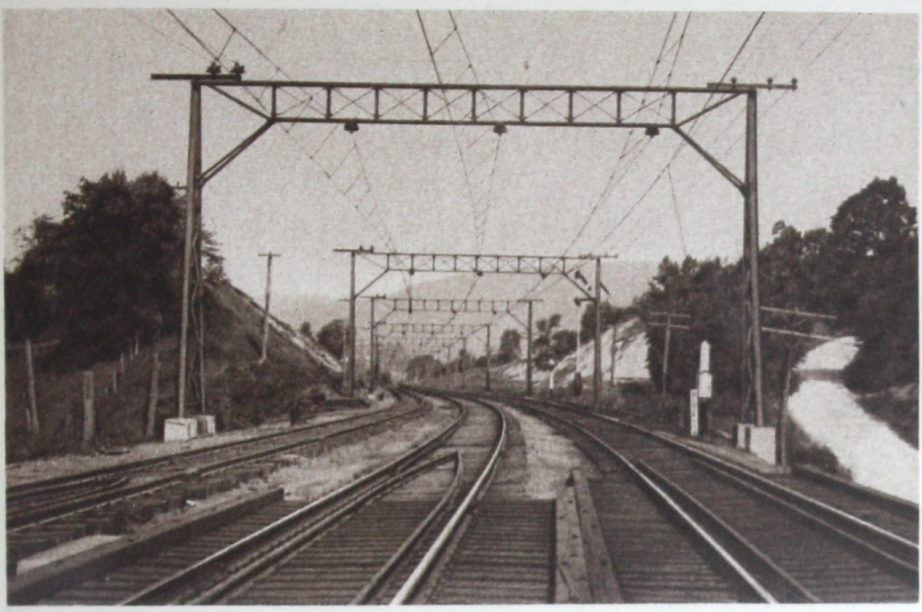
The upper right-hand view shows a Laced Angle Pole with "A" Frames in distance on 53-mile 60,000 volt line of the AUGLAIZE POWER COMPANY of Ohio, R. R. Livingston, Engineer, No. 2 Rector St., New York. The Poles carry the line through villages, ballance of line is on "A" Frames.

The lower left-hand picture shows Structure of the UTICA G. & E. CO. at Trenton Gorge on line described in the lower picture on page 17.

The lower right-hand illustration shows Poles of the FONDA, JOHNSTOWN & GLOVERSVILLE R.R. CO. on the line described on page 13.







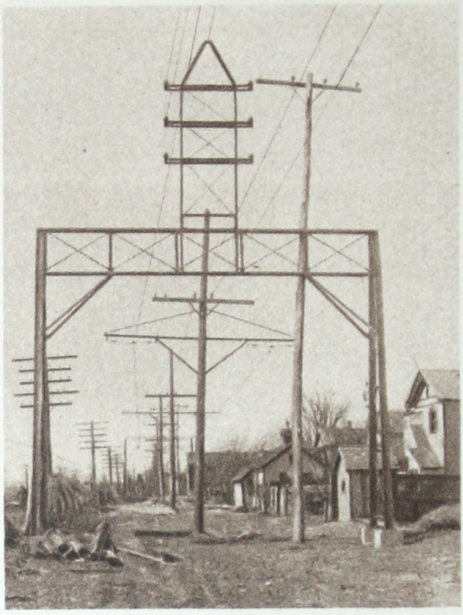
PERMANENT OVERHEAD CONSTRUCTION

The upper illustration opposite shows Catenary Construction on the Northfield relocation of the NORTHERN OHIO TRACTION & LIGHT COMPANY lines built especially for high speed service between Cleveland and Akron. The Bridges are spaced 300 ft. and 4/0 copper trolleys are suspended from 500,000 C. M. stranded copper feeders by flexible hangers, spaced 25 ft. centers. The 33,000 volt high tension circuit is strung with No. 0 copper wires with steel ground cable above.

The HOOSAC TUNNEL Overhead Construction on BOSTON & MAINE R.R. shown above operates at 11,000 volts A. C. Outside of the tunnel it is carried by Steel Bridges. At some points cross spans are used with "A" Frame supports. A No. 3/0 copper sub-messenger and a No. 3/0 phono-electric contact wire hang from a $^{5}/_{8}$-in. plow steel strand messenger.

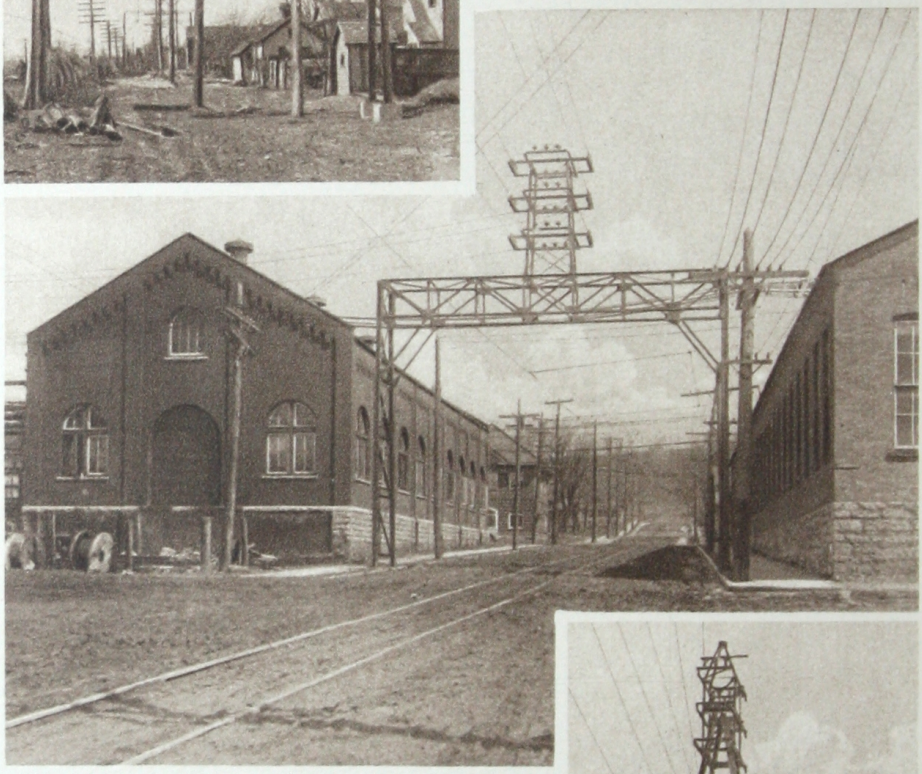
THE EMPIRE UNITED RAILWAYS, Syracuse, use nearly 1,000 Trolley Bridges of the type shown opposite. Two 500,000 C.M. copper feeders are used as messengers from which are suspended No. 4/0 copper trolley wires. The two 33,000 volt circuits are No. 2 copper. The Bridges are spaced 300 ft., and the hangers 60 ft. This construction has been in service from four to seven years with practically no maintenance charges.

The best type of Overhead for a railroad can be determined only by careful study of the proposed line as regards curvature, voltage, foundations and working conditions. In general, light and simple construction of wires, insulators and supports is most reliable to operate and easiest to maintain. Heavy steel cables and massive rigid supports are not only unnecessarily expensive, but invite insulator troubles. The first cost of a properly designed system of overhead, supported on Steel Bridges, is not usually much greater than that of high class wood pole construction, while the annual charges, including maintenance and replacements, may be even less.



BRIDGES AT DIFFICULT TRANSMISSION LINE LOCATIONS

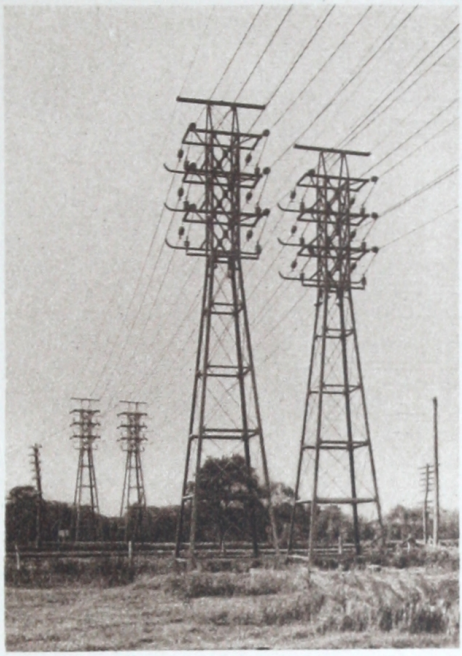
The upper and center views are on line of the FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD COMPANY, described on page 13. The pictures show how the cables were adequately supported with minimum obstruction to the right-of-way and street.

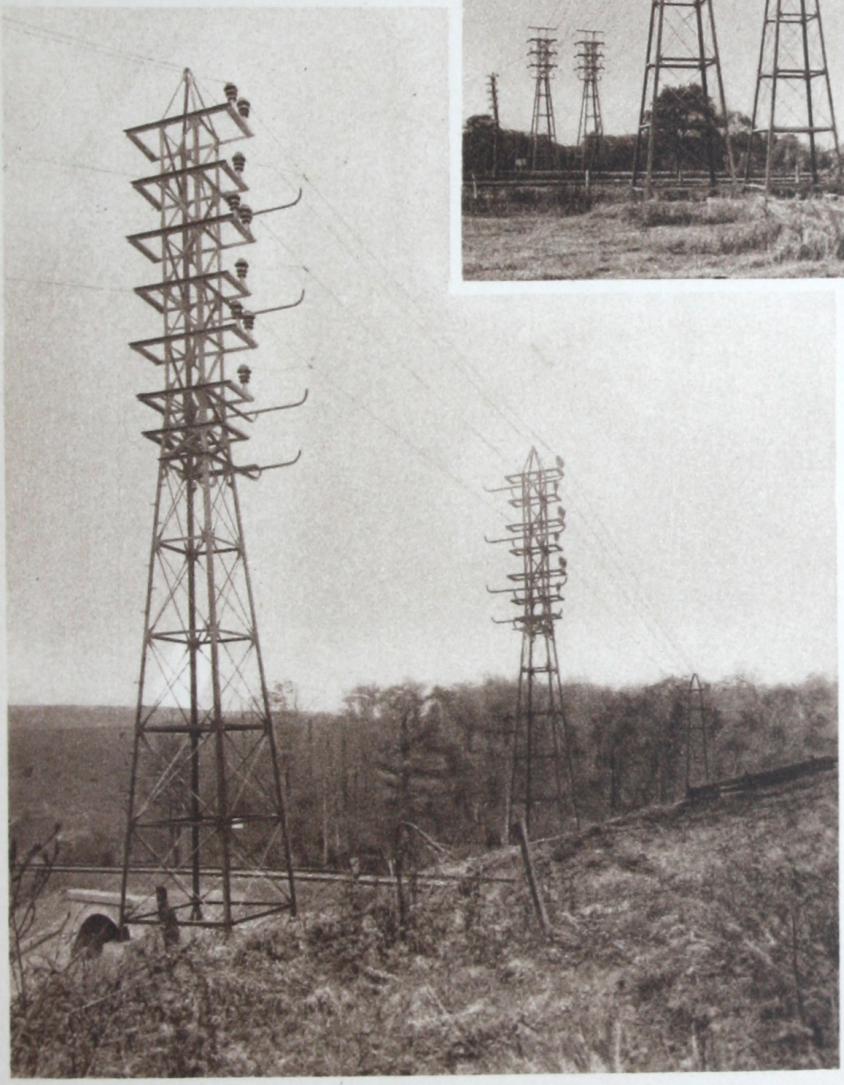


The lower view shows combined Bridge and Tower Structure near the Power Houses of the NORTHERN OHIO TRACTION & LIGHT COMPANY at Cuyahoga Falls. Two 3-phase transmission lines are brought down on Bridges spanning track and are dead-ended on the Structure shown. One circuit is carried from the Tower across the Cuyahoga River, an 800-ft. span. Four steel guard wires, installed over the line as a protection against trees falling across the line, have already proved their efficacy. These Structures solved difficult problems.

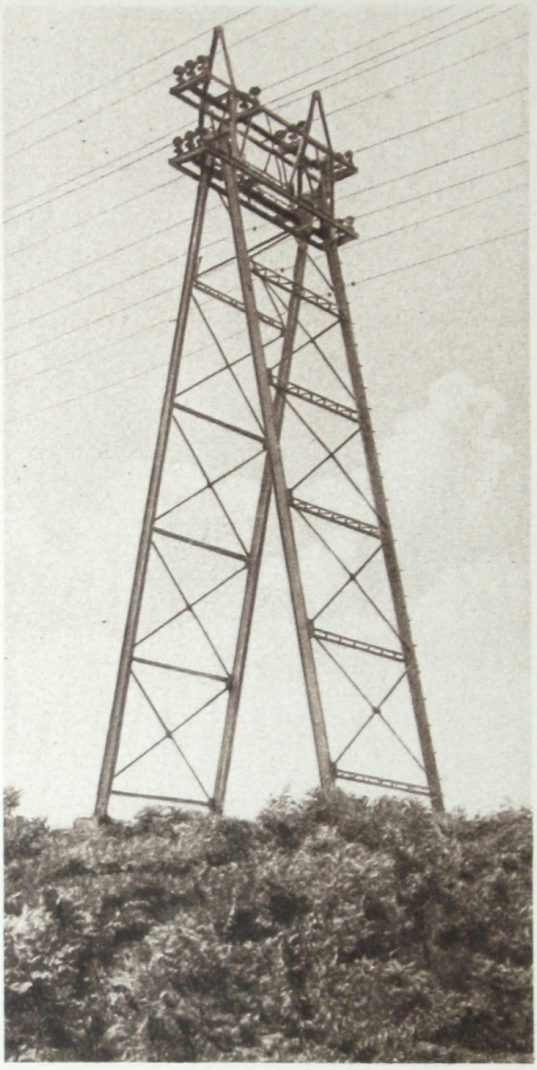
TRANSMISSION CROSSINGS OVER RAILROADS

The upper view shows Crossings over the N. Y. C. & H. R. R.R. Co. on line of the NIAGARA FALLS POWER COMPANY described on pages 6 and 7.



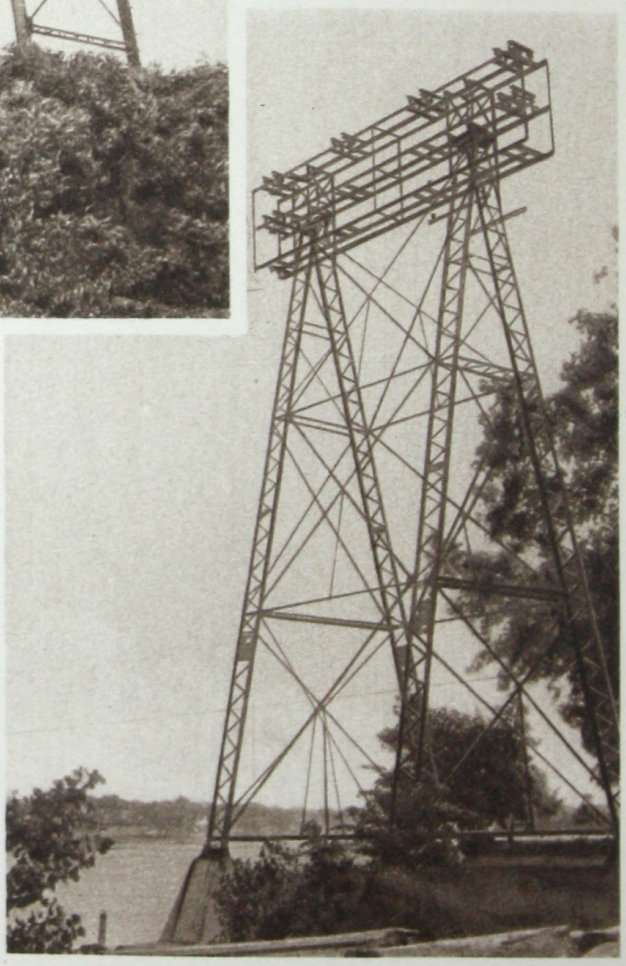


The lower view shows Crossing over New York Central Line of the PENN CENTRAL LIGHT & POWER COMPANY, Altoona, Pa., Day & Zimmerman, Philadelphia, Pa., Engineers. The Structures are built to carry two 45,000 volt circuits and one 6,600 volt circuit according to the steam railroad company's specifications. We have built many such Crossing Structures to comply with the differing requirements of various railroads.



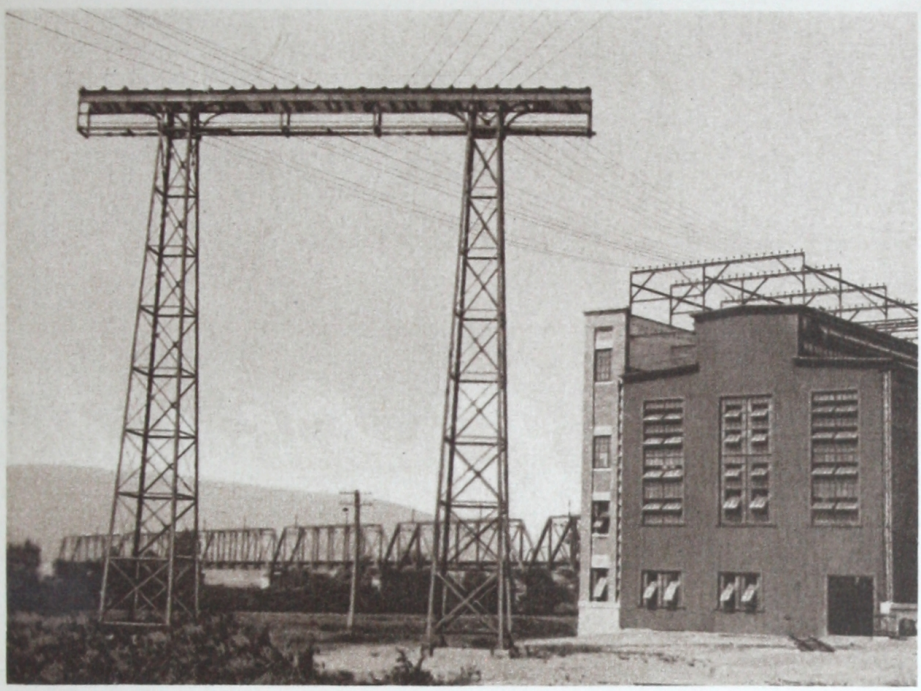
telephone wires. The vertical members of the Tower are 15 in. 38 lb. Bethlehem "I" Beams.

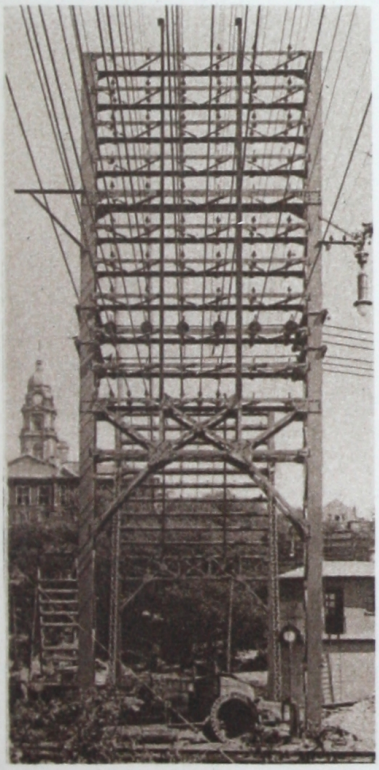
The view below shows a 12 wire, 77 ft. Structure of the UNITED TRACTION COMPANY of Albany, N. Y., carrying one end of a 1400 ft. span over the Hudson River from Lansingburg to Waterford, N. Y. The six conductors now strung are No. 3/0 silicon bronze strand.



HEAVY STRUCTURES FOR LONG CROSSINGS IN NEW YORK STATE

The view above shows Tower of the ADIRONDACK ELECTRIC POWER CORPORATION on an 800 ft. span over the Mohawk River at Cohoes, N. Y. The Structure, 79 ft. high, carries six No. 3/0 hard drawn copper cables with two ground wires and two



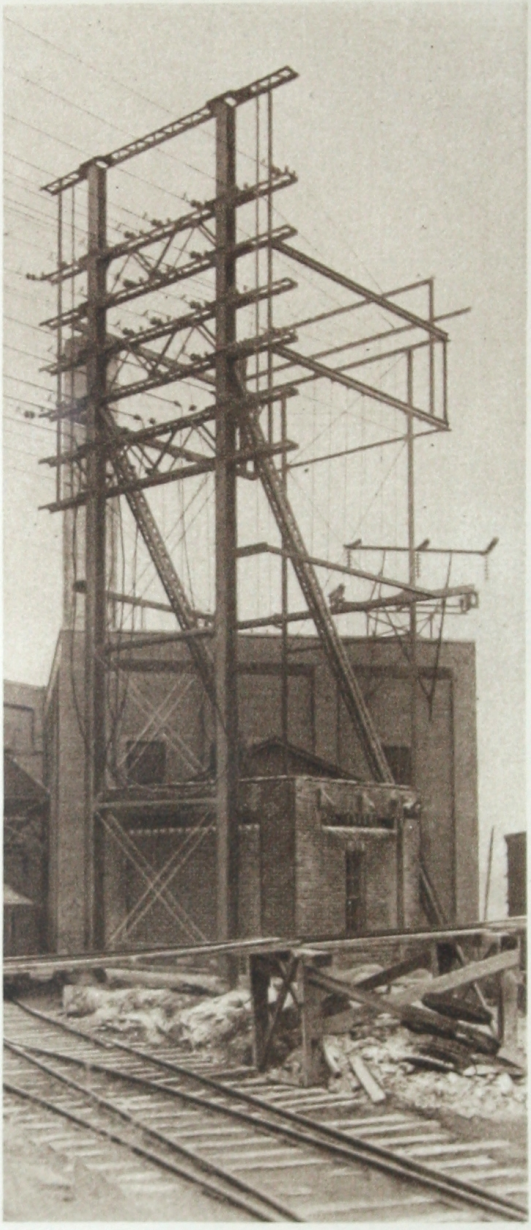


WIRE BRIDGE

This Bridge at the Power Plant of the DELAWARE, LACKAWANNA & WESTERN RAILROAD COMPANY at Nanticoke, Pa., was installed in connection with the line pictured on page 18. The Bridge is 75 ft. high, 72 ft. long, carries eight 3-phase 4200 volt 4/0 copper strand circuits and has a working platform suspended below the wire supports.

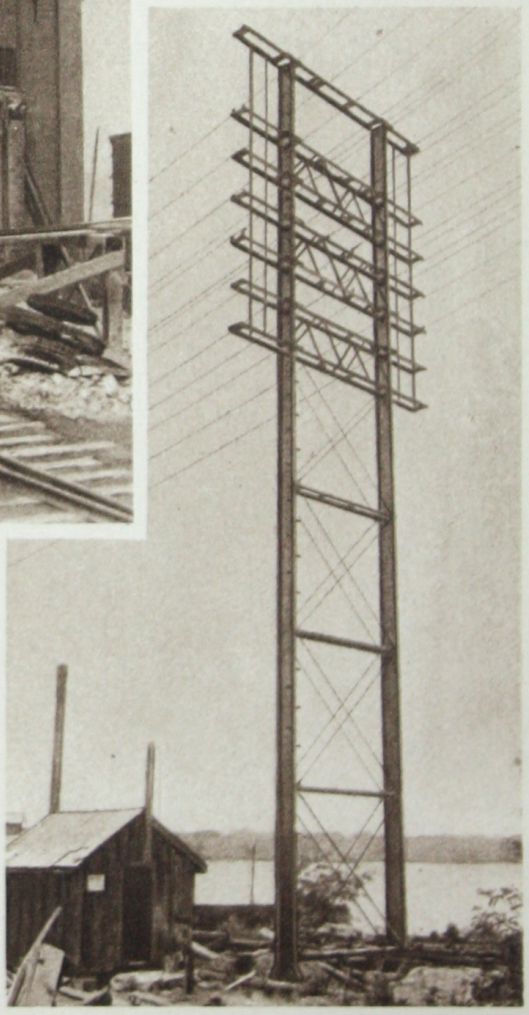
STRUCTURES FOR HEAVY LEAD IN TEXAS

The two side Structures shown carry the wires and cables of the FORT WORTH POWER & LIGHT COMPANY from their new plant at Fort Worth to the distributing lines. This lead is heavy, as will be noted, and thoroughly substantial construction was required. The Cleveland Construction Company of Cleveland, Ohio, were Engineers for the Company.



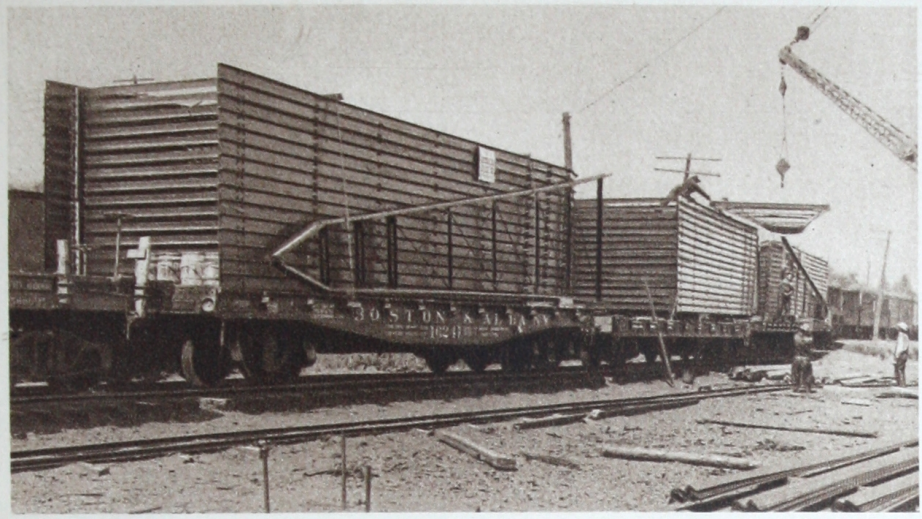
house over which the Dead-end Structure was built. At present 36 wires and cables ranging from No. 4 arc light circuits and 13,200 volt feeder circuits up to 500,000 C.M. railway feeders are installed.

The Structures and those shown on pages 20 and 22, are parts of the distributing and transmission lines between Alton and East St. Louis. Extremely difficult right-of-way conditions necessitated a great variety of Structures. We are glad to give special study to such requirements.



STRUCTURES CARRYING HEAVY LEAD FROM POWER HOUSE

The two views show Dead-end Structure and intermediate Structure built for the EAST ST. LOUIS LIGHT & POWER COMPANY at Alton, Ill., to carry 54 wires and cables from terminal



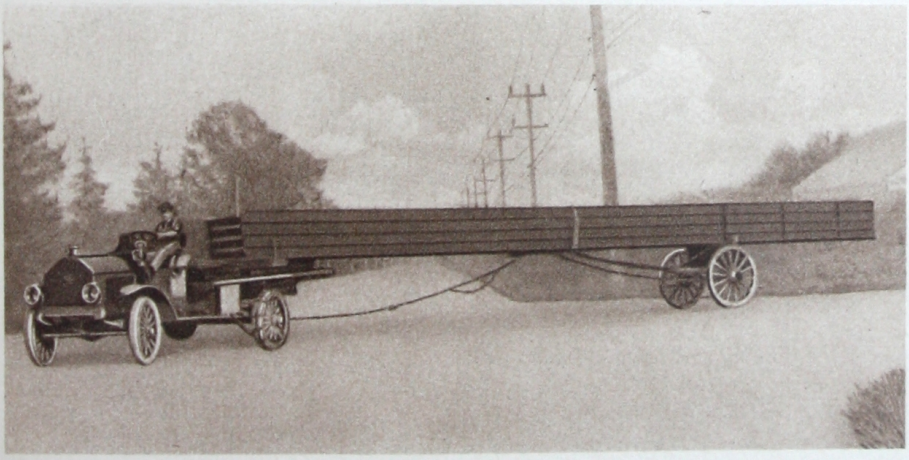
LOADING, UNLOADING AND HAULING OUR STRUCTURES

Loading a four-car load of "A" Frames at our shop for the ALABAMA POWER COMPANY.

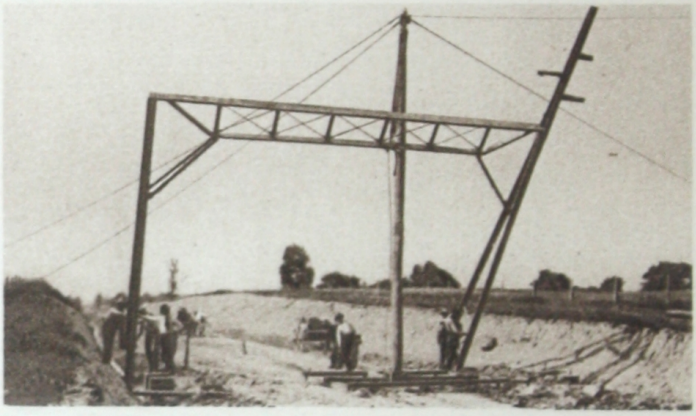
BERKSHIRE STREET RAILWAY COMPANY, Fred T. Ley & Company, Inc., Contractors, unloading and setting "A" Frames along N. Y., N. H. & H. R.R. by a derrick on the line described on page 14.

Auto-truck of the DOMINION POWER & TRANSMISSION COMPANY hauling "A" Frames on the line described on page 12.

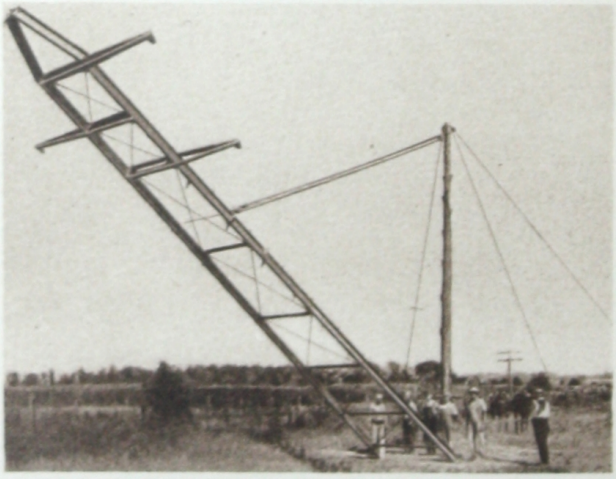
NOTE HOW EASILY THE ASSEMBLED AND RIVETED STRUCTURES ARE HANDLED.



RAISING LACED CHANNEL POLE ON LINE OF THE VIRGINIAN POWER COMPANY IN WEST VIRGINIA



RAISING CATENARY BRIDGE ON INTER-URBAN LINE OF NORTHERN OHIO TRACTION & LIGHT COMPANY BETWEEN AKRON AND CLEVELAND



RAISING "A" FRAME STRUCTURE ON LINE OF MUNCIE ELECTRIC LIGHT COMPANY OF INDIANA

We call attention to the facility with which our Structures can be handled and the low field cost which follows these designs. We solicit your inquiries and suggest your giving us requirements as to voltage, whether suspension or pin type insulators are to be used, length of your line, clearance from ground at low point of sag, size and kind of cables and the general character of the country. We should also be advised whether or not particularly narrow base construction is desirable.